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WE have cited several great shaft sinking records in the recent issues of the ENGINEERING AND MINING JOURNAL, and we add to this list the last month's work at the Tamarack new shaft No. 2, which was sunk 93 feet 2 inches in the month of January. When the nature of the rock is considered, this is, we believe, the highest record ever made in shaft sinking. The miners received the well-earned premium of $100 for breaking the record.

WE commend to our readers the very interesting and valuable paper on "Lixiviation of Argentiferous Zincblende and Galena Ore," by Mr. OTTOKAR HOFMANN, which is in course of publication, on another page. Such careful, intelligent, and exhaustive work is rare, much too rare, in our metallurgical literature, and Mr. HOFMANN has placed the profession under heavy obligation to him for these investigations, and for the interesting record of them which he has communicated to the ENGINEERING AND MINING JOURNAL.

THE DEBRIS QUESTION IN CALIFORNIA.

We have on several occasions* referred to the anti-mining policy pursued in California, and we note that the anti-mining papers of the State have taken us to task for what we said, claiming that the ENGINEERING AND MINING JOURNAL is the organ of the hydraulic miners, etc. It is scarcely necessary to refer to these statements and accusations that are very wide of the truth. We are the friends and advocates of legitimate mining, and we do believe that gross injustice has been done this great industry in California, and we also believe that it is to the interest of the State and of the whole country that the mischievous and unjust laws that now practically prohibit hydraulic mining in California be modified so as to allow the working of gravel mines under such restrictions as will secure the rights of the farmers and of those who use the navigable streams of the State.

We advocate nothing but even-handed justice. If a gravel mine is to be worked let the condition be that it may not destroy other persons' property without fair compensation. There certainly is no justice in not permitting the mine to be worked under any conditions.

In the case of an industry of such enormous value to the country, this law might provide some simple, direct and inexpensive means of condemning property which is necessary for the carrying on of the industry, upon paying a fair price for it, the same to be determined by a board of competent experts, and if the law requires the mine to impound the débris, the adjustment of the respective rights of miners and farmers can surely be adjusted by a competent commission. At present the risk which capital runs in California gold mines is so greatly increased by the laws of the State that it is and should be all but impossible to interest it in their development.

*ENGINEERING AND MINING JOURNAL, November 10th, December 8th, 1888, and January 26th, 1889.

We are informed that within a few weeks Judge KEYSER, well known for his anti-mining rulings, enjoined a mining company, composed of citizens of New York, from working a mine upon which the company had expended a million or two of dollars, although it was mining on its own lands, with its own water, brought many miles at great cost, was taking care of its tailings by impounding all of them upon its own land, except about 10 per cent, which it transported some thirty miles through a canal upon its own land, constructed at great cost, to its own swamp lands and with expectation of improving these. Doing harm to no one, injuring no property, but benefiting a large section of country by carrying through it in its large canal (400 feet wide), all the winter floods, which used to deluge that country every rainy season, and with no possibility of any débris getting into any river or stream. This injunction throws 150 men out of remunerative employment and closes a valuable mine which turned out $200,000 to $250,000 a year. This injunction was granted on a petty bond of $10,000. By no possibility could the operations of this company injure the plaintiff or any other person. This is the result of the anti-mining crusade in California. Such facts are quite sufficient to deter capatalists from investing in California gold mines, and the loss to the State of many millions of dollars annually is but the natural result of the gross injustice its laws do a great industry. Let the law be changed, as it may be, to protect the miner as well as the farmer, and in a few years millions of money will again find profitable employment in the industry to which California owes its existence as a State.

THE PRODUCTION OF COPPER IN THE U. S.

Mr. CHARLES KIRCHHOFF, Jr., has published a preliminary estimate of the production of copper in 1888, which he is collecting for his report to the U. S. Geological Survey and we give it herewith, making comparison with the figures which the ENGINEERING AND MINING JOURNAL collected and published a month ago. Mr. KIRCHHOFF'S figures differ from those collected by us in some particulars in which we have the direct returns which show that his estimates are not yet complete. When they are, he will find that his aggregates will be considerably greater than those he now publishes.

Copper production in the United States in 1888, as estimated by the ENGINEERING AND MINING JOURNAL, January 12th, and by Mr. C KIRCHHOFF, February 12th, 1889, is:

	1888. Kirchhoff. Pounds.	1888. E. & M. J. Pounds.
Lake Superior	86,404,993	86,840,000
Arizona	31,797,300	33,200,000
Montana	97,897,968	98,500,000
New Mexico	1,631,271	2,000,000
Colorado	1,221.100	3,000,000
Utah	2,131,047	2,500,000
California	1,170,021	
Wyoming	232,819	
Nevada	50,000	
Idaho	50,000	4,960,000
Maine and New Hampshire, Vermont	271,631	
Southern States	18,201	
Lead desilverizers, etc	2.618,074	
Total domestic copper	225,494,425	231 000,000
From imported ores	4,909,156	5,000,000
Total	230,403,581	236,000,000

The Lake Superior production, the returns of which are given in detail, substantially agrees with our statement, only such small variations as occurred between the estimated and actual output in December having affected the total. In Arizona, Mr. KIRCHHOFF'S figures are evidently incomplete, our direct returns from six mines alone giving about one and a quarter million pounds more than his total figures. Apparently one large mine has been overlooked.

In Montana the difference is less, but our figures will again be found more complete than these later estimates, unless Mr. KIRCHHOFF applies some "personal equation of error" to modify the direct returns of the mines. The distribution of the balance of the copper produced among the other States and Territories is necessarily made by a careful comparison of the details furnished by the refining companies and the smelters, and in the case of Colorado particularly, the Geological Survey estimates apparently have not included some important items of the production.

After comparing the figures of production published in detail in the ENGINEERING AND MINING JOURNAL January 12th, as corrected by later returns received by us from such of the producers as had any correction to make in their early reports we are convinced that our figures, though not absolutely accurate, are yet more complete, and, therefore, more reliable, than these "preliminary estimates" of the Geological Survey. No doubt the Survey's final statistics, which we shall receive some months hence, will have filled these gaps, which now amount to several million pounds. It is very important that official statistics be both full and accurate, and Mr. KIRCHHOFF is a very accomplished and painstaking statistician.

With regard to stocks Mr. KIRCHHOFF makes no estimate except as to the

stock in the hands of the syndicate on January 1st, and this is not given officially. With regard to the consumption of copper in 1888 he says:

"Consumption has undoubtedly fallen off, although not to the extent which was probably widely expected. Reports from 109 consumers—among them nearly all the great copper and brass rolling mills and the leading brass founders, including also large new concerns which did little or nothing in 1887, like the Tamarack & Osceola Manufacturing Company and the Hartman Steel Company—reports from these works show an aggregate consumption of *new* copper in 1888 of 76,124,641 pounds, against 82,458,378 pounds in 1887. This indicates a falling off of 7·68 per cent. The true effect of high prices is, however, more correctly appreciated when the fact is taken into account that the very rapid rate of increase in copper consumption of former years has been overcome. In 1887 this increase amounted to 14 per cent. The condition of general business in 1888 was favorable enough, so far as the consumption of metals in this country was concerned. The quantity of lead and spelter absorbed showed the effects of a natural growth, and leaving out of account the lessened consumption of steel rails, the quantity of iron and steel which found its way into the hands of purchasers was normal. The facts admit of drawing the inference that the cessation of a natural increase of and the substitution therefor of a notable decrease in the consumption of copper in the United States was due directly to the abnormally high price for the metal established through the operations of the French syndicate. It must be distinctly stated that the figures for the consumption given do not cover more than a part of the quantities absorbed in the United States. They are believed, however, to represent very closely the true ratio which would be reached were it possible to obtain the complete data. The principal ground for this belief is the fact that all the important industries into which copper enters as a raw material are represented in the returns by the majority of the concerns, large and small."

The method here adopted for obtaining the consumption never can give full returns nor very accurate ones. Experience has shown us that the consumption of copper can be estimated more accurately by obtaining the production, imports, exports and stocks, than it can be by estimating from the partial figures that alone can be obtained from consumers. We believe that the consumption declined last year even more than Mr. KIRCHHOFF'S figures indicate, as already explained in the ENGINEERING AND MINING JOURNAL, January 12th.

THE UNDERGROUND ELECTRIC WIRE QUESTION.

Another explosion of gas in the man-hole of an electric sub-way in this city comes like a signal-gun to herald next week's convention, at Chicago, of the National Electric Light Association. If it be asked, Why fire the gun in New York, the answer may be, perhaps, that in Chicago it would attract no attention. They don't mind an occasional explosion there; they call it "solving the underground problem." It reminds them that their electric conductors, in all but 22 of their 23 wards, are really underground. Here in New York, however, it is mistaken for a sign of danger. The press, which has been vigorously insisting that there was no difficulty at all in the safe and efficient underground installation of electric wires, says this thing "must be prevented." But the press does not say how.

The problem of safe and efficient underground conduits and conductors for electric arc-light currents is everywhere pressing upon municipal authorities. Nobody desires to put a stop to the manifold application of distributed electric energy, which promise to add so much to the comfort, convenience, and productive capacity of the people; but the multiplication of overhead wires, after the present chaotic fashion, has reached the maximum, not merely of public tolerance, but, in many cases also, of engineering practicability. The overhead business is not only exasperating the people; it is choking itself to death.

In the case of the high-tension currents for light and power, the public safety is most directly involved. The cheap and inadequate insulation, careless arrangement and inefficient inspection and maintenance of such overhead wires and connections, is criminal. If it be true, as the last convention of the National Electric Light Association, in August last, after a long discussion, unanimously declared by resolution that "up to the present time no commercially practical method has ever been brought to their notice by which high-tension direct currents, such as are used for arc-lighting, can be placed underground," it is still more clearly true that the means of making overhead conductors of that class practically safe are perfectly well-known, and ought to be enforced by the proper authorities, by public sentiment and by the companies engaged in the business. No new legislation is needed on this point. Sufficient power for the purpose resides in the ordinary municipal governments. On this head, the approaching convention ought to take a decided stand.

But there is another duty, for which this occasion is most opportune. In the current discussion of the different phases of the underground problem, great harm continually results from ignorance of the facts, whether of theory, of laboratory-experiment, or of actual practice. The elements of the present confusion are chiefly these:

1. The newspapers, bound to get "news," include under this head "alleged" facts, rumors, "important if true" assertions of inventors and cranks, and wild predictions of what science will do, as soon as it is "demanded" with sufficient energy.

2. Moreover, editors feel themselves bound to make immediate comment on such "news." The leading metropolitan journals, having the most intelligent editors, surrounded by the best reference-libraries and files, give the tone to the country press, in which their editorials are echoed with more or less verbal variation. But in the case of electrical problems, there are unfortunately no authorities in print, by which an editorial writer, however quick-witted and expert in "cramming," can safely be guided As has been well said by a leading author on this subject, there are two sciences of electricity—that of the shop and that of the books. The former has always been far ahead of the latter; but the interval between them is greater to-day than ever before. There are indeed some books, proceeding or professing to proceed from the shop; but even these are out of date in a year after they appear; and, moreover, they are apt to be unskillfully put together, without comprehensive and logical arrangement, deficient in candor as well as in clearness, and fantastic in theory, as the productions of men who know how to practice, but not how to theorize, are likely to be.

3. Even the science of the shop is not consolidated in its progress. The practical experts are hard at work, making inventions, securing patents, and selling them to capitalists; and those who possess, besides, the capacity to take general views and make clear scientific statements, are in great demand, at high salaries, as superintendents, consulting experts, and witnesses in patent cases. Each of them keeps to himself what he knows, unless he has already protected it by patents.

When, in 1886, President PLYMPTON, of the Brooklyn Board of Subway Commissioners, visited Europe, for the purpose of personally examining the practice, and consulting the scientific experts, in underground electric systems, he was informed by Mr. SIEMENS himself, and by his chief electrician, that the special problems which he submitted to them, and upon which American practitioners were already actively engaged, had never been considered in Europe at all.

Even if our newspapers employed technical experts to write editorials on technical subjects, (a practice which has been almost universally abandoned in this country) an electrical expert editor could scarcely keep up with the progress of the genius and industry displayed in American laboratories and shops. At least, the miraculously acute and active intelligence which could do so would be speedily gobbled up at a large salary, and plunged into a business which would leave him neither time nor inclination to write. We cannot wonder, then, that the average journalist falls back on non-committal generalities, enlivened by public-spirited attacks on public officials, grasping monopolies, etc., and by such easy epigrams as "The way to do it is to do it!" What he lacks is knowledge. Who will give it to him?

4. The press has become, in such matters, nothing more than the gossip of the community. Whether it forms or follows public opinion, need not here be discussed. Certain it is, that what the newspapers say is said at the clubs and over the breakfast-tables. Nobody (unless in the rural districts) "swears by" his newspaper any more; but everybody swears with it. The "news" is never quite correct, but it is near enough for a working hypothesis, in affairs for which no other information is furnished; and the editorial may be hasty, superficial and unjust, but if it assails the greed of capital, asserts the rights of the people, scourges the indolence or incompetence of office-holders, and intimates the existence of universal corruption, it is "on the right side." There is so much evil a-going, that vigorous measures are required. If the guardians of public virtue do not see exactly at whom they should aim, they are right in firing a volley into the mob. Innocent people may get hurt; but they should not be there. Thus we reason, all of us, until *we* are the innocent people hurt; and then we do not reason at all, but either yell with rage and pain, or crawl away to nurse our wounds, quite indifferent as to the next batch of victims.

In the matter now before us, a justifiable demand for the abatement of a public nuisance and danger has been swelled, in some instances, to an unjustifiable clamor. An Oriental despot, ordering his wise men to read his dream or cure his daughter forthwith, and cutting off their heads if they fail, is not more unreasonable than a press and public, commanding that this, that or the other shall be "solved" or "invented" forthwith. But the press and the public do not mean to be tyrannical or absurd. They simply believe that the thing can be done, has been done, and is only not done in a particular place because of the fault of those who ought to do it or enforce the doing of it. And they believe this, because they have been told so, and have no means of distinguishing correct and disinterested information on the subject from the reckless assertions of ignorance and the deliberate misstatements of selfishness.

These sources of misinformation are not always separate. Selfishness is usually ignorant, or but partially informed. Alone or together, they are responsible for much mischief; and some of this mischief it is in the power of the National Electric Light Association, which contains the men who know most, though they say least, about the matter, to remedy

In the first place, let the representatives of capital and of scientific skill in that association take hold of this question in earnest, with the definite purpose of hastening, not delaying, or even merely awaiting the final solution of it. Even if the overhead conductors were not a nuisance at all; if the law did not command their abatement at the earliest moment; if the public rather liked them;—still, as everybody in the business knows, it would be high time to devise a radical change in the present system. The immense increase of electrical business

(doubling the wire-mileage within the last three years, introducing arc-light systems into between one and two hundred cities within the last two years, and extending to-day at a geometrical rate which defies Subway Commissioners almost as completely as the birth-rate of the heathen defies missionaries) requires instant reform. *Any company using high-tension currents which will so perfect its system as to be able to guarantee good and safe underground service at reasonable rates* will find profit, as well as glory, in so doing; and the rest will have to follow suit, or abandon the municipal field, with the "millions" that are "in it." While they fool away their opportunity, low-tension systems, like the Edison, are comfortably occupying the streets with their conduits, getting the right of way, and securing the business. In all probability, the alternating high-tension system is the coming one. We hazard little in prophesying that if the Edison people can find any way to get into that field, they will do it; and the first thing our dilatory 2000 volt, underwriter-wire friends know, they will find even the underground doors shut in their faces. *

THE LIMITATION OF AMERICAN BY FOREIGN PATENTS.

The bearing of the recent decision of the United States Supreme Court in the case of the Bate Refrigerating Company upon the rights of the holders of American patents for inventions previously patented abroad is important enough to justify us in explaining it to our readers at some length. Such an explanation is the more appropriate, because the statements of the newspapers have been, on this matter, unusually obscure and unintelligent. To the ordinary inexpertness of reporters and editors, obliged, at short notice, to write with a knowing air upon a subject they did not understand, have been added a series of amazing interviews with lawyers and litigants, some of whom were interested in exaggerating, while others were equally desirous to diminish the force of the decision, and still others were apparently so pleased to be consulted as "eminent authorities" by the representatives of the press, that they were willing to expatiate learnedly upon a document they had not seen.

The full text of the decision, while it furnishes material for an accurate judgment, furnishes so much more in its detailed recital of the facts of the particular case, not essential to the general principles involved, that its perusal would weary the reader unprofitably. We shall therefore try to state the essential facts in brief and general form.

1. The U. S. patent law (Sec. 4887 of the Rev. Statutes) provides that "every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term, and in no case shall it be in force for more than seventeen years."

This provision, we would observe in passing, renders the investment of money in the purchase of American patents for inventions already patented abroad a perilous business. All the rights under such an American patent may be terminated suddenly by the expiration of a prior foreign patent, without notice to the American owner. Approximate safety requires a thorough inquiry, before purchase, as to all prior foreign patents, the terms of each, the patent law of the country in which each has been granted, and especially the conditions upon which it may be forfeited before the end of its full term; and to this must be added, in some cases, a constant vigilance, lest some neglect on the part of foreign patentees should cause the lapse of their patents and so destroy the American one. Perfect safety requires the absence of any foreign patents which can possibly lapse prematurely through such neglect, or through any violation of their conditions.

2. The Canadian statute of 1872 provided that patents should be "valid for a period of five, ten or fifteen years at the option of the applicant," requiring him, however, to apply at or before the end of the first five years for an extension over the period of the second five, and in similar manner, at or before the end of that period, for the final extension of five years more.

3. The distinction between the term of a patent and its "extension" was clearly made under the U. S. patent law of 1839, under which the term of the patent was 14 years, and an extension for 7 years might be obtained upon satisfactory proof of the value of his invention, and the time and labor spent in its introduction without adequate return to the inventor. The extension was granted to the inventor, not the owner of the expiring patent. It was granted as a voluntary act of the Government for considerations of equlty; the original patent conveyed no right to it, and no covenant, express or implied, that it should be granted. Evidently, this was a sort of extension differing essentially from that of the Canadian statute, which the government was bound to grant, at the option of the applicant, whether the original inventor or the "holder," on the simple condition of a timely application, and the payment of the legal fee. Whatever the form of the patent itself, the statute contained this covenant, and the patent therefore contained a valid, negotiable and transferable right for fifteen years, subject only to periodical applications and payments.

4. The actual form of the Canadian patents, under the statute referred to, was that of a grant for five years only, and the U. S. Circuit Courts, apparently misled by the analogy of the former United States statute, have repeatedly held that in such cases the term named was the term of the patent, and subsequent extensions could not be counted in fixing the time when the patent "expired," so as to limit the term of a corresponding American patent of later date. If we remember correctly, this ruling has, in some cases, on the strength of the phraseology of Austrian patents, decided their term to be but one year—to the consternation of the owners of most important American electric inventions, unfortunately patented in Austria before the American patents were issued.

5. It is a common practice among American inventors, for fear of such interference, to make application first in the United States and afterwards in foreign countries. But, as everybody knows, it is also a common practice of the U. S. Patent Office to be a long while in granting an application; and it not infrequently happens that the late application in a foreign country results in a patent antedating the tardy final action of the Washington office. The question may thus become very important, whether the rights of the American patentee should be abridged by the fault of his own government, after he has done everything in his power to comply with the law, and to avoid this misfortune.

The foregoing points were involved in the *Bate Refrigerating Co.'s* case, as the following outline will show. Instead of giving dates, we arrange the facts in chronological order:

6. A applies for a U. S. patent.

7. A applies for a Canadian patent, covering the same invention.

8. The Canadian patent is granted "for five years," as explained under No. 2. above.

9. The U. S. patent is granted for seventeen years, subject, of course, to the statute as explained in No. 1, above.

10. An extension of the Canadian patent was granted for five years, in accordance with the Canadian statute.

11. In a suit of A against B in the United States for infringement, B set up in defense the lapse of the Canadian patent by the expiration, of its "term," notwithstanding its extension. The Court sustained B and defeated A.

12. An act was passed by the Canadian Parliament, declaring the meaning of its former statute to be, that the term of the patent was fifteen years, subject to certain conditions to be fulfilled by the applicant or holder. On presenting this act in a U. S. court, A was flatly informed that it is the business of courts, not of legislatures, to construe the meaning of laws once passed; and that the Parliament of Canada could not impose upon U. S. judges its *ex post facto* enactments.

13. A decision was obtained from a Canadian Court (in a pretended suit got up by A, who paid the lawyers on both sides) annulling the Canada patent of A as void *ab initio*. This decision being produced by A in the United States Court, to prove that there really never had been any valid Canada patent, the Court "reversed itself," and sustained A

14. The Canada court (probably on information from B), finding out that it had been imposed upon, indignantly revoked its former decision and restored the Canadian patent to its pernicious validity.

15. A sues C for infringement, and is beaten on the same grounds as in No. 11 above.

16. The case is appealed to the Supreme Court, on the facts as above stated, and A claims:

a. That the date of his application for a United States patent, and not that of the actual issue of it, should affect his rights; in other words that the Canadian patent is not really a prior patent within the meaning of Sec. 4887 of the Revised Statutes.

b. That the expiration of a foreign patent contemplated by that section means its actual final expiration, not merely the end of its first term, or the term named in its first issue. The words employed in the pleadings are, "It means that it shall expire when the foreign patent expires, without reference to the limitations of the term of such foreign patent in actual force at the time the United States patent was granted." This seems to be a skillful attempt to bring in the later Act of the Canadian Parliament, which, though it could not alter the meaning of the earlier law, for the past, was competent to fix it for the future, and thus had positively fixed the term of the patent at fifteen years, whether the original grant had done so or not.

17. With its usual caution, the Supreme Court declines to consider *a*, because its answer to *b* decides the case. It is therefore still uncertain whether the date of application or the date of issue in the United States, decides the question of priority between American and foreign patents.

Under *b*, the Court declines to go so far as to accept the general principle pleaded by *A*. It says merely that in this case, the extensions being provided for by the Canadian statute in force when the United States patent was granted, and also when it was applied for, and being a mat-

ter of right on the part of the patentee, and the patent having been kept continually in force, without interruption, through term and extensions, "the United States patent does not expire before the end of the fifteen years' duration of the Canadian patent."

18. It will be noticed that the Court does not say the U. S. patent will expire at that time. That would be to declare the Canadian patent really prior, and thus to answer *a*, which the Court has declined to consider.

Nor does it say that an extension of the Canadian patent made by subsequent act of Parliament, or in the exercise of discretionary power by the Canadian Patent Office, but not assured as a matter of right to the Canadian patentee, at the time of the U. S. application or issue, would be counted as postponing its expiration for the purpose of determining the duration of the corresponding American patent. Its careful language intimates the contrary.

Nor does it say that the lapse of a day or an hour, during which the Canadian patent was not in force, though afterwards renewed or extended, even though the extension were officially dated back to cover the interval, would be overlooked. On the contrary, it quotes the decision of the Rhode Island Circuit Court, in *Henry* vs. *Providence Tool Co.* (Oct., 1878), where a British patent was thus extended *post mortem*, in a way to permit the inference that the present case, presenting no such lapse, is essentially different.

19. The scope of the decision has been exaggerated, but within its narrow scope, it happens to affect a number of immensely important cases, especially those which involve some fundamental electrical patents. We shall recur to this subject in another article. *

CORRESPONDENCE.

We invite correspondence upon matters of interest to the industries of mining and metallurgy. Communications should invariably be accompanied with the name and address of the writer. Initials only will be published when so requested.
All letters should be addressed to the MANAGING EDITOR.
We do not hold ourselves responsible for the opinions expressed by correspondents.

Value of the Engineering and Mining Journal.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: We take great pleasure in expressing our appreciation of and high esteem in which we hold your peerless paper, the ENGINEERING AND MINING JOURNAL.

We have always found your columns full of valuable scientific and engineering reading matter, edited with a strict adherence to truth, your work showing careful and painstaking efforts to obtain facts, which are presented to your readers without fear or favor. Your unflinching exposure of fraud in every form connected with mining matters, deserves the highest praise and the thanks of all honest men.

We have used your advertising columns constantly ever since our company was organized, with the most gratifying results, and we can trace more inquiries, which have brought us orders, to your paper than to any other out of the large number in which we advertise.

Wishing you the success which your efforts so richly deserve, I am,

Very sincerely yours, M. C. BULLOCK.

CHICAGO, Feb. 13, 1889. Prest. M. C. Bullock Manufacturing Co.

The Disadvantages of Rico, Colo., as a Smelting Center.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: In the ENGINEERING AND MINING JOURNAL of January 12th, I notice that your special correspondent for Dolores County, this state, is inclined to travel the well-worn path of the boomers of mining camps *in extremis*. I refer to vague grumbling at local reduction works. Having held the position of general manager of the Grand View Mining and Smelting Company at Rico for three years previous to their abandonment of the business, at my urgent and repeated advice, I feel called upon to defend myself and my company from the inferences that might be drawn from your correspondent's letter.

In his resumé of the smelting advantages forsaken by this deluded concern he says that the ores carry an abundance of iron, manganese, lime and lead. Perhaps he does not know that the ores produced in Rico during 1886 and 1887 required an addition, per ton, of 520 pounds of 45 per cent iron flux and 250 to 300 pounds of pure limestone flux to afford a slag of 32 to 34 per cent silica, 26 to 28 per cent metallic iron and manganese, and 14 to 16 per cent lime. I know it because I bought the fluxes. He ought to know that the ores will never carry, as an average, 3 per cent of lime if he has the faintest geological glimmering as to the character of the ore-bearing formations of the district. As to the lead, he is correct if he goes back to 1886 and 1887, when 15 to 18 per cent were available for smelting mixtures. In 1888, however, I ran on from 9 to 12½ per cent, and I do not know where even that proportion could now be obtained in the camp at living rates.

Your correspondent does not mention that the "convenient" coking coal occurs 8½ miles away from the central point of ore production, that it occurs in a 16 inch seam which produces with the most careful mining and burning a rusty, friable coke of low reducing power, utterly devoid of strength, costing $11 to $13 at the works under the most favorable conditions of transportation. The charcoal obtainable is burned from quaking-aspen timber, is tender (but not true), and costs 15 cents per bushel of 14 pounds, including 15 to 20 per cent waste. Coal delivered in Rico is worth $6.50 to $7.50 per ton, according to the season. Bullion is hauled over two ranges 32 miles to railroad, the expense of marketing, exclusive of silver deduction by refiners, being about $58 to $60 per ton. Furnace labor commands $3 to $4, and common labor $2.50 per day. Expense of roasting in reverberatories, $4.25 to $5 per ton (matte).

The ores run quite uniformly, 4 to 5 per cent in sulphur, producing in shaft furnace, 250 to 450 pounds of matte per ton of ore smelted, to be crushed, rolled, roasted and re-smelted with its silver contents subjected to roasting and double smelting losses. The production of matte could be avoided, of course, if the sulphur were concentrated within a small ore tonnage, but it is so uniformly distributed through a given stock that ore roasting is not practicable economically. By the way, where did your correspondent discover that there is any difference between sulphide and sulphate ores so far as their behavior is concerned in the formation of matte in shaft-furnace smelting?

A most important factor in the smelting proposition which he omits to mention is the fact that for three years past, the total product of this district has amounted to something less than 5 tons per day and that in consequence, the one 36 × 70 furnace of the Grand View Company has been in blast an average of ninety days per year for 1886, 1887 and 1888.

This ninety days' run, as a business proposition, should carry the taxes, sinking fund, interest on capital and profit and loss accounts for twelve months. It should also keep open doors every day in the year for each man with 50 pounds or 50 tons of ore to sell, paying him cash on the sample, and carry the ore an average of four and half months until an accumulation of stock and "cheek" should warrant a blow-in. If some smelting genius will take the above data and figure out a profit on an average working charge of $14 to $15 after paying an average of ninety-three per cent of silver values and 20c. to 30c. per unit for lead contents of his stock, he may have my metallurgical and financial scalps without protest.

In connection with the reflection that the Grand View Co. carried smelting charges to the last limit in the absence of competition, I will assert that during the past three years I have smelted hundreds of tons of the more desirable ores at less than cost of *delivery* to outside smelters, paying 95 per cent. of silver value and 25 to 35c. per unit for lead contents.

Metallurgically, the results obtained were satisfactory to myself and the company, and with twice the amount of business they would have been so commercially, even under the onerous conditions of which I have spoken.

The general policy under my management was to stimulate production and increase our business by the lowest scale of rates we dared to offer, and it was on this line that the Grand View Co. stayed by Rico year after year, hoping against hope to bring out its own investments and those of the district generally, receiving an annual budget of encouragement and recognition of its pluck in the shape of a tax schedule amounting to $1 *per ton of ore purchased* in course of business.

The very ore itself, exempt from taxation at the mines, was taxed when purchased by this concern, and carried for months when the roads to railroad were hopelessly blocked by snow, a burden that I do not believe has been laid upon any other smelter in this State.

So long as we remained in the camp we were robbing the poor miner and laying up untold profits: now that we have left, we did not know our business or we must have succeeded,

I have no desire to decry the advantages that Rico does possess, and they are not inconsiderable, but I cannot submit without protest to reflections that are but feeble endeavors to locate a lack of prosperity where it does not belong, for no camp in this or any other country ever had a staunchcr, harder-dying backer than the Grand View Company has been to Dolores County.

Local smelters have ever been favorite scapegoats for mining camps, and it is time they had a recess. Meanwhile, perhaps your correspondent will inform us more definitely as to why the Pasadena Reduction Company, the Rico Reduction Company and the Santa Clara concern, all of Dolores County, threw up their hands some years since, leaving their property (the two latter) to the tax collector? Yours truly,

C. E. PALMER,
Late General Manager Grand View M. & S. Company.

ASPEN, Col., Feb. 1, 1889.

RECOVERY OF AMMONIA AND CHLORINE IN THE AMMONIA SODA PROCESS.

The following abstract of a paper by Mr. Fred. Bale, read at the recent meeting of the British Association for the Advancement of Science, is taken from our contemporary, *Industries:*

When ammonium chloride is volatilized, and the vapor passed over or through heated metallic oxides at a temperature of about 400 degrees C., 25 to 50 per cent of the ammonia evolved is decomposed. If, however, the ammonium chloride be intimately mixed in powder with powdered oxide of manganese, on heating, the ammonia is gradually and completely evolved at a temperature of 130 degrees C. to 325 degrees C., without the loss mentioned above after the evolution of the ammonia. Cold or dry air can be drawn over the heated residue, which can in this way be entirely freed from any moisture or undecomposed ammonium chloride. Air may also be passed through the retort throughout the whole operation, and thus prevent any leakage, and at the same time reduce the decomposition to a minimum. Nickel oxide, when substituted for oxide of manganese, causes the ammonia to be freely given off at about 325° C., and after the passage of the air chlorine comes off at about 500° C. Other oxides require a much higher temperature for the evolution of the chlorine. The percentage yield of chlorine is (with few exceptions) about one and a half times as great when a peroxide is used as when a monoxide is used at the same temperature. The sesquioxides yield as a rule about one-third less ammonia than would be expected from theoretical considerations, the remaining third being resolved into nitrogen and hydrogen. Oxides which by this process are converted into sesquioxides may, by reduction with charcoal or small coal, be obtained in a form which will then give the same equivalent of ammonia as at first. The author proposes to use this process in connection with the ammonia soda method for preparing bicarbonate of soda, and thus prevent the loss of chlorine as chloride of calcium, which has little commercial value. He is also of opinion that there would be a large saving of labor and fuel in the manufacture of ammonia. He claims by his method of mixing the oxide or oxides with the ammonium chloride the advantage of being able to readily expel the whole of the ammonia present at a low temperature. It differs also in the movable character of the oxide or oxides used, and the low temperatures employed throughout, and in the use of atmospheric air for the expulsion of the ammonia and steam from the retort. Trimanganic tetroxide, or any other oxide of manganese except the sesquioxide, or magnesia, or a mixture of these two, seem to

give the best results. An ordinary Stourbridge fire clay retort is employed. It is important for the successful carrying out of the process that the temperature of the retort be increased gradually, and as soon as the evolution of ammonia has ceased there is a distinct pause in the reaction. It is also essential that the moisture be removed by the passage of dry cold air over the heated residue before the chlorine, which is subsequently evolved is led into the bleaching powder chambers. The chlorine is evolved as soon as the temperature is raised to a dull red heat, and dry and hot air is substituted for the cold air. If the air be carefully passed, chlorine to the extent of 9 to 12 per cent of the issuing gases is evolved when manganese is the oxide used. The residue, after all the chlorine has been evolved, is practically equivalent when reduced to the oxide originally used, and can be used for a subsequent charge, making the process a continuous one. It is necessary, however, for this residue to be removed from the retort at intervals of about a week, and washed from common salt if that body is present in the ammonium chloride. Except for this impurity the retort need not be opened, as the ammonium chloride is thrown in at the mouth of the retort and mixed at once with the oxide by shutting the door of the furnace and causing the scarifier to revolve. If the retort be heated by a self-feeding and practically automatic coke furnace, with properly arranged flues, the initial temperature can be obtained by the workman placing a mercurial thermometer through the door of the retort from time to time. The proportion of sal-ammoniac to oxide which is found to give the best yield is one of the former to four of the latter. This composition of the mixture insures the complete decomposition of the chlorides or oxychlorides, and also prevents any fusion of the chlorides or caking of the retorts. Besides the oxides above named, other heavy oxides and oxides of the alkaline earth metals may sometimes be used with advantage. The salts of these oxides have also been used with satisfactory results, and also the different varieties of clay when purified from iron. Of these substitutes, cobalt oxide alone, or mixed with magnesia, appears to be the best in giving the equivalent of ammonia, and in the ease and low temperature at which the chlorine is evolved. Magnesia reacts somewhat on the retort when one of fire-clay is used. Cobalt chloride is also slightly volatile, while nickel oxide requires a higher temperature for the evolution of the gases, although it has the advantage of existing as a monoxide at a high temperature, and therefore needs no subsequent reduction. The manganese oxide, and also some of the other oxides above mentioned, after several operations, become oxidized to sesquioxide, and thus cause a loss of ammonia if not reduced by coal. The reduction is effected by shutting off the air supply and adding small coal to the extent of about one fiftieth the weight of the oxides used. The gases from a coke furnace may also be passed over the residue when it is more convenient to effect the reduction by their use. The fire-clay retorts which Mr. Bale recommends are of special manufacture, and are made sufficiently non-porous to prevent the ammonia passing through it into the fire. They are worked in series, and are connected with a supply of air, which is drawn through them by an exhauster during the evolution of the ammonia, and by a blower when the chlorine is evolved. In order to control the temperature as far as possible, the retorts are heated either by coal gas, or, as mentioned above, by a self-feeding coke furnace. The retorts are set horizontally, and are fitted with covers at each end with pipes for the passage of the gases. In the preparation of bleaching powder with the dilute chlorine, the author has found that the action on the lime is sufficiently energetic, while at the same time the temperature does not appreciably rise. The disadvantages arising from the use of ammonium chloride containing small quantities of sodium chloride on a large scale, are obviated by previously subliming the salt, the additional expense of this operation being more than compensated by the several advantages gained.

Electrolysis of Copper Salts.—Mr. Alexander Watt has recently commenced a new series of electrolytic papers, this time on the "Electrolysis of Copper Salts," which are now being published in the London *Electrical Engineer*, the first of the series appearing on January 11th. In the course of these experiments Mr. Watt has endeavored to discover, if practicable, a coppering solution which would serve as a substitute for cyanide baths for giving a preliminary coating of copper upon iron and steel articles which are to receive a thicker coating in ordinary sulphate baths. He hopes that among some of the solutions tried, may be found several which may be worth further experiment, on a small practical scale, by persons desiring to obtain a substitute for the cyanite of copper solutions.

THE CONSTRUCTION OF CUPOLAS FOR MELTING PIG IRON.*

By M. A. Gouvy Jr.† Translated by W. F. Durfee, Engineer.

The translator, regarding the paper of M. Gouvy as of great value to all maufacturers of iron and steel, inasmuch as it presents, in one comprehensive view, most of the experiments that have been tried in many lands, with the hope of improving the working of cupolas, offers to English readers the substance of it, in the belief that, if its conclusions are intelligently followed by users of cupolas, very large economies will result; for his own investigations, many years ago, led to the conclusion that the most of the cupolas then into use in this country, wasted three-quarters of the fuel put in them, and that there were but very few, indeed, that utilized one half; conclusions which observation in recent years has furnished no reason to change.—W. F. D.

PURPOSE OF THE PAPER.

It is intended in this paper to glance cursorily over the successive improvements which have been made in the construction of cupolas for the fusion of pig-iron, since their use has become general in metallurgy, and to give some information relative to certain special methods of construction which have been invented, based upon principles more or less understood, and to describe a few of the more recent forms of apparatus which have attracted the most attention from metallurgical engineers In these pages, therefore, will be found a description of the most important inventions relating to the cupola, as well as an account of the results obtained in the most of the cases, together with a discussion of the value of the most important of the systems described.

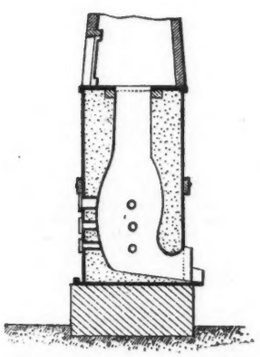
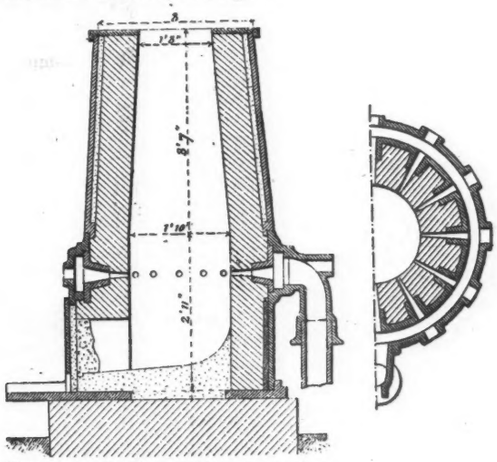


FIG. 1.—Cupola with Rammed-up Walls.



FIGS. 2, 3.—Cupola of the Foundry in Berlin.

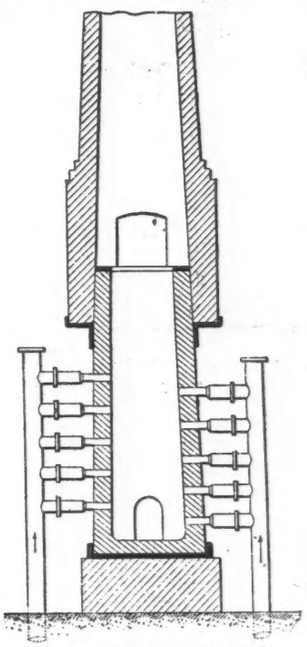


FIG. 4.—Common French Cupola.

I.

FIRST APPARATUS USED FOR THE FUSION OF PIG-IRON.

The first melting of pig-iron was accomplished probably in crucibles, which were heated by coal in a furnace in which the consumption of fuel was very great.

In order to avoid this inconvenience, those who first made castings from pig-iron had recourse to an apparatus similar to a cupola, called a "Calabash," which was fired either with coal or coke.

Valerius speaks of "calabashes" at Brussels‡ using coke, which consumed 77 to 88 pounds of coke for every 220 pounds of castings made, without counting the coal used for heating the "calabash," or the coke wasted.

The "calabashes" at Charleroi consumed 81·5 to 95 pounds of coke for each 220 pounds of iron melted, besides 2·7 to 3 per cent of coal; the waste of iron was not more than 5 to 6 per cent, as in ordinary cupolas.

Reaumur describes the "portable calabashes," which we remember are still used in the country by the gypsies for repairing saucepans.§

Among the more recent endeavors to augment the very small melting capacity of the "calabashes" we find the cupola, originally invented by Wilkinson (1790), and called a "shaft furnace," or "cupola."

The first stationary furnaces were provided with "shafts" or "cupolas" of masonry at their tops, from which the gas escaped, and it is probable that from this construction we derive the name ("cupola") in common use at the present time.

These cupolas were of very primitive construction, having but a single tuyere, and their shafts either rectangular, oval or circular, in cross-section, their wall being formed of refractory sand rammed into a casing of cast iron, a construction which required frequent repairs. Their height was not often more than five or eight feet. Charcoal was used as a fuel, and the quantity consumed was exceedingly great, often, in

* From the Journal of the Franklin Institute.

† "Etude sur les cubilots pour la fusion de la fonte. ParM. A. Gouvy Fils 'published in "Mémoirs et compte rendu des travaux de la Société des Ingénieurs Civils." Paris, 1887, pp. 723-766.

‡ Valerius: "Traité de la fabrication de la fonte." 1851.

§ The making of castings from iron melted in crucibles and in "calabashes" is illustrated and described in Emanuel Swedenborg's "De Ferro," published in 1734. W. F. D.

fact, amounting to fifty per cent of the very small production of the furnace.

A cupola of this kind is represented by Fig. 1.

A cupola was built at Seraing (about 1850) having rammed walls, which were repaired once in eight days, and entirely renewed every six weeks: the crucible or bottom being repaired three times per week. The product per hour was about one ton of castings, with a total consumption of coke in the neighborhood of twenty per cent. We must here observe, that, notwithstanding the improvement in the cupolas used in foundries at the present time, it is rare good luck if, in economy of coke, they attain or surpass the above figure.

In China, where industrial progress for a long time has been almost nothing, they use small furnaces eight feet in height, with about the same width, having an internal diameter of the crucible of two feet, and provided with a single tuyere.* These furnaces are charged with a mixture of ore, cast iron and charcoal; from which are produced cooking utensils of remarkable thinness and lightness.

Cupolas having superposed tuyeres.—For the purpose of accumulating a large quantity of iron in the crucible for the making of large castings, the primitive system of fixed tuyeres is replaced by a series of superposed tuyeres, which are opened successively, and the preceding tuyeres stopped, as the level of the bath of iron in the crucible rises. The cupola of a foundry in Berlin† (Figs. 2 and 3) is of this construction. The system was for a long time employed in France, and perhaps is still in vogue in some foundries (Fig. 4).

* *Chemical News.*

† Bruno Kerl: "Handbuch der Metallurgischen Hüttenkunde," 1855.

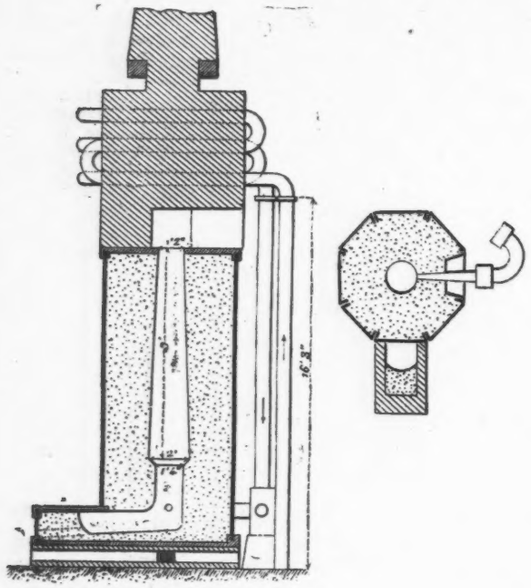
II.

THE EMPLOYMENT OF HOT BLAST AND THE UTILIZATION OF THE GAS ESCAPING FROM THE TOP OF THE FURNACE.

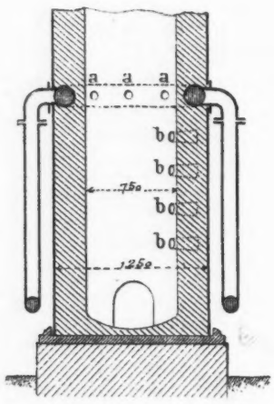
Since the emuloyment of cupolas in foundries has become general, a great number of patents for improvements have successively been issued.

A modification which was at first considered as of great importance, but afterwards gradu lly abandoned, consisted in the utilization of the gas wasted at the top of the furnace, for the purpose of heating the blast, with a view of obtaining a larger production of castings with a smaller consumption of fuel.

Kerl‡ mentions, among others. a cupola employed in the Hartz, which was blown with air heated in U-tubes placed horizontally in its chimney (Figs. 5 and 6). This cupola was fired with charcoal.



FIGS. 5, 6.—Cupola in the Hartz Mountains.



a. *Hot blast.*

b. *Cold blast.*

FIG. 7.—The Ronchain Cupola.

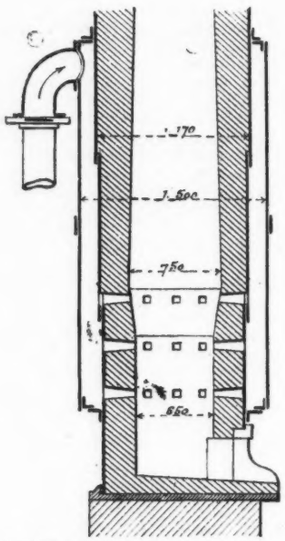
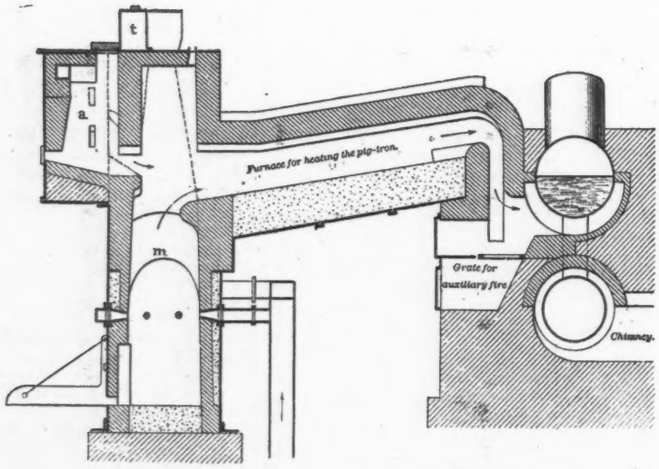
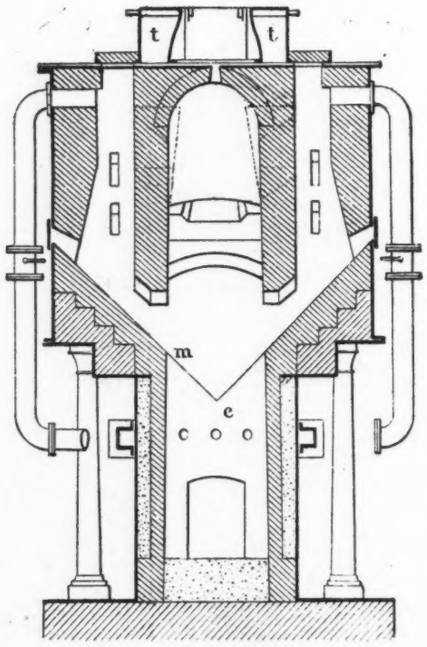


FIG. 8.—The Woolwich Cupola.





FIGS. 11, 12.—The Daelen Cupola (Scale 1 — 48).

The same author also describes a furnace at Saynerhütte, which had an apparatus for heating the air. This consisted of two annular boxes connected together by vertical tubes, which were heated by the gas from the top of the furnace, and through which circulated the blast, which was thus heated to from 370 degrees to 470 degrees F.

Still, the use of the waste heat for raising the blast to a certain temperature was subject to the following inconveniences, viz.: it was in fact difficult to place the apparatus above the cupola without greatly augmenting the cost of construction and at the same time causing a back pressure, which interfered with the normal working of the furnace; furthermore, the intermittent working of these foundry cupolas rendered it practically impossible to employ their gas for heating steam boilers as readily as in the case of blast furnaces.

‡ Bruno Kerl: Handbuch der Metallurgischen Hüttenkunde, 1855.

We believe that the waste gas can be used for drying the coke intended for fuel, by passing it under cast-iron plates on which the coke is spread; another use would be to preheat the iron to be melted, which, having been placed in a small reverberatory furnace located on one side of the top of the cupola, is heated to a red heat and then pushed into the cupola.

All these methods were so complicated that they have been abandoned, and more simple arrangements have been sought for heating the blast without using the heat lost at the top of the furnace.

For this purpose Cabrol obtained a patent for a system by which the air was heated by actual contact with incandescent coal in a special closed chamber, thus charging the blast with carbonic oxide, and obtaining a very high temperature in the cupola.

Wright & Brown pass the blast, before it enters the furnace, around the melted iron. Although Kerl asserts that in Silesia they obtain by the employment of heated air a more rapid fusion, and with less waste of iron, it appears that these systems have not as yet given the results predicted by their authors, but have been successively rejected, either for the reason that their construction was too complicated, or from the absence of real advantages.

Nevertheless, these attempts have been continued in the same direction, and in 1871 Sir R. Mallet mentioned the Summerson cupola, which was blown with heated air.

The Ronchain Cupola.—Ronchain, of Maubeuge, patented, in 1885, a cupola having a passage for the blast within the masonry, in which the air was heated before it entered the cupola by the upper tuyeres (Fig. 7). The lower tuyeres were opened at variable heights according to the quantity of iron in the crucible, in order to avoid exposing it to the action of the cold air.

Ronchain reports a consumption of 22 pounds of coke for the fusion of 220 pounds of iron, and about 30 pounds consumed before charging the iron.

The Woolwich Cupola.—At Woolwich there was a cupola that had a

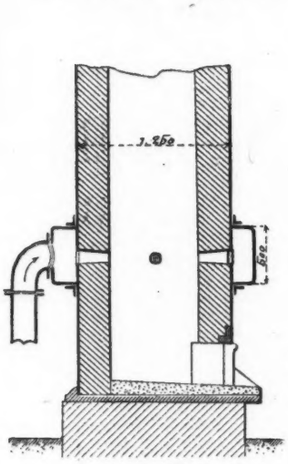


FIG. 9.—Cupola with an Annular Wind-Box.

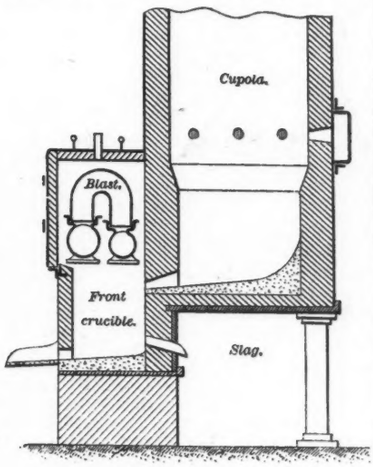


FIG. 10.—The Tittl and Erndt, or Modified Krigar System.

wind-box whose dimensions may be called enormous, as it extended from the tap-hole of the furnace almost to its top (Fig. 8). It had three rows of tuyeres, spaced one foot apart vertically.

We find also in Armengaud's publication* the description of a cupola having a wind-box (Fig. 9) communicating directly with the interior of the furnace by orifices which take the place of tuyeres. Such an annular box intended for heating the air is also employed by Voisin.

Tittl and Erndt's System.—Quite recently (in 1885) a detached crucible applied to a cupola, according to the system of M. Krigar, has been patented in Bohemia by MM. Tittland Erndt.† In this system the blast traverses the tubes placed above the detached crucible, which are heated by the flame that passes out of the cupola through the lower orifice, and also by the radiation from the bath of melted iron (Fig. 10).

The Sheffield Cupola.—An arrangement which appears more practical than those already mentioned is described in *The Engineer*‡ as being employed in the steel works of Brown, Bayley & Dixon, at Sheffield.

In this apparatus the blast pipes are connected to a series of sixteen U-tubes sixteen feet in height, having 1,700 square feet of heating surface; these are placed in two chambers located at the top of the chimney of a Bessemer converter; the waste heat from the converter passes into these chambers, thus heating the blast intended for the cupolas, which are thirty-seven feet in height, and have two rows of tuyeres placed one foot apart; the diameter at the tuyeres is four feet, and at the crucible five feet.

The temperature of the blast is from 360 to 445 degrees F., and we are told that the consumption of coke (for melting probably) is not more than 6·6 to 7 pounds per 100 pounds of iron melted.

Finally, we conclude that the employment of heated air for blowing cupolas, only results in an increase of their melting power in consequence of the elevation of the temperature of the zone of fusion; but we do not find any economy of fuel, which fact is attributable to the zone of fusion extending to a very much greater height than when cold air is used, and therefore the carbonic acid formed at the tuyeres encounters a very large surface of incandescent coke, which effects a reduction of this gas, and the advantages of heating the blast are annihilated by the loss of heat due to the transformation of this carbonic acid into carbonic oxide.

The Daelen Cupola.—Notwithstanding all the experiments that have been made without decisive results, M. A. Daelen recommends a very complicated German construction which proposes to utilize the waste heat of the cupola, not only for the fusion of the iron, but also for producing the steam necessary to drive the blowers.§

We will now describe this curious arrangement, which in fact demonstrates that the search for theoretical perfection does not always result in an invention which is at the same time practical and simple.

The cupola (Figs. 11 and 12) was designed for the use of raw coal, on the principle of the Duméry hearth (Paris, 1856), still in use for many purposes; in this construction the gas, after traversing the raw coal, is directed in a state of ignition upon the metal to be melted.

The Daelen apparatus is in reality a combination of a coke-oven provided with a blast, a cupola and a reverberatory furnace, for the utilization of the waste heat of the cupola.

The raw coal is first coked in the chamber *a*, and the coke produced is pushed into the cupola *c*, until it is filled to the level *m*, and as the chamber *a* is emptied we continue the charging of raw coal by the hopper *t*.

As soon as the iron which has been placed upon the hearth of the reverberatory furnace becomes red, it is pushed directly into the cupola.

This cumbersome and costly apparatus appears to be without utility, and it is not to be supposed that it would have given very satisfactory results.

(TO BE CONTINUED.)

LIXIVIATION OF ARGENTIFEROUS ZINC BLENDE AND GALENA ORE.

Written for the Engineering and Mining Journal fly Ottokar Hofman, M.E.

(*Continued from page* 138.)

ROASTING IN THE STETEFELDT FURNACE.

The furnace was a large size Stetefeldt furnace, claimed to roast 60 tons per day. It was built strictly according to Stetefeldt's latest designs, including dust chambers and stack. I examined the plans and found that in all details the measurements were strictly observed.

Though I made quite elaborate experiments I was not able to obtain good results, in fact, they were far from being satisfactory. Nevertheless they are interesting and, at the same time, useful, inasmuch as they establish the fac that an ore like the "Del Oro," containing 25·5 per cent zinc, 11·56 per cent lead and 21 per cent sulphur is by far too refractory for the Stetefeldt furnace. Such an ore requires to be submitted to a long and gradually increased temperature before the salt is added. The principle of the Stetefeldt furnace, however, is just reversed to this important condition, and the results, as a matter of course, could not be satisfactory.

Notwithstanding that I had a very powerful draft through the furnace, and that the ore was crushed through number 40 screen, only about three eighths of the ore (by volume) was carried by the draft into the descending flue and deposited at the bottom of the chambers, while about five eighths of it came down the shaft. Actual dust was not carried beyond the second dust chamber, and even there only small quantities deposited, owing to the great specific gravity of the ore.

After heating the furnace gradually for three days I commenced charging. I had twenty stamps running and crushed through number 40 screen from 20 to 22 tons per twenty-four hours, according to the amount of salt used. I commenced with 8 per cent of salt, increasing it during the time of the experiments to 16 per cent. I also tried oxidizing roasting, also first oxidizing and then adding the salt at intervals to the ore at the bottom of the shaft, but without success. The furnace was kept running for seven days and was then stopped, as no signs of improvement in the work could be noticed and the cooling floor was filled with badly roasted ore.

Before making any comments, I will give the average results obtained under different conditions:

Roasting with 8 per cent salt.

	Shaft. Ozs. per ton.	Descending flue. Ozs. per ton.
Average of raw ore, including salt	32·37	32·37
Average of roasted ore	34·41	29·67
Average of leach tailings	28·62	23·72
Average of chlorination	16·90 p. c.	20·20 p. c.

Roasting with 12 per cent salt.

	Shaft. Ozs. per ton.	Descending flue. Ozs. per ton.
Average of raw ore.	31·00	31·00
" " roasted ore	31·33	27·50
Average of leach tailings	26·60	10.78
Average of chlorination	15·20 p. c.	60·80 p.c.

Roasting with 16 per cent salt.

	Shaft. Ounces per ton.	Descending flue. Ounces per ton.
Average of raw ore	30·32	30·32
" " roasted ore	33·39	29·81
" " leach tailings	28·35	22·30
" " chlorination	15·20 p. c.	25·20 p. c.

Oxidizing roasting.

	Shaft. Ounces per ton.	Descending flue. Ounces per ton.
Average of roasted ore	34·91	28·57
" " leach tailings	32·65	17·41
" " with "hypo" extractable silver	6·5 p. c.	39·20 p. c.

I charged the oxidized ore from the descending flue into a tank, treated at first with a diluted solution of chloride of copper, then leached with water and afterwards with sodium hyposulphite and obtained tailings containing 14·43 ounces per ton, showing an extraction of 49·5 per cent silver.

RE-ROASTING THE ORE FROM THE SHAFT.

The ore which had passed through the Stetefeldt furnace once was sifted to free it from lumps, and charged a second time:

	Shaft. Ounces per ton.	Descending flue. Ounces per ton.
Average of roasted ore	31·49	31·49
" leach tailings	31·34	24·79
" chlorination	9·4 p. c.	22·30 p. c.

Observations and Comments.—If we compare above results we find

* Armengaud: Publication Industrielle. Vol. 22, p. 185.
†*Dingler's Polytechnisches Journal*, 1885. Vol. 258, p. 445.
‡*The Engineer*, 1879, p. 321.
§*Dingler's Polyt. Journal*, 1866.

that those obtained in the shaft were pretty nearly equally bad, whether more or less salt was used. In the descending flue 12 per cent of salt gave the best result (60·8 per cent chlorination). An excess of salt lowered the chlorination. The same observation I made afterwards in the Howell and reverberatory furnaces.

The ore from the shaft has a very dark, almost black, color, emits volumes of sulphurous acid gas when discharged, but no chlorine. By leaving the ore in a pile on the cooling floor it continues to emit sulphurous acid gas for a couple of days, without a marked increase in the percentage of chloridized silver taking place. In dropping through the shaft the main portion of the ore is transformed into minute globules, which shows that, while the ore falls, it is partially slagged. Trying to avoid this I lowered the fire so much that the lower part of the shaft was quite dark, while in the auxiliary place I let the fire go out entirely. This, however, did not produce any change; the ore came down now as before in globules, while in the descending flue the temperature continued to be very high. It is apparent that the ore when sitted into the shaft creates by the sudden combustion of the sulphurets an extremely high temperature in the upper regions of the shaft, which causes the suspended ore particles to slag to globules. That under such circumstances silicates are formed which, incrusting the ore particles, prevent their further oxidation and chlorination, is apparent.

An analysis showed that the roasted ore still contained 8 per cent of unoxidized sulphur. Ores containing not more than 8 per cent sulphur usually roast well in a Stetefeldt furnace, and I expected that by changing the ore a second time we might obtain good results. The ore was sifted to free it from lumps and charged again. The result, however, proved to be worse than that obtained in the first roasting. The chlorination of 15 and 16 per cent was reduced to 9·4 per cent. The ore maintained its dark color and continued to emit heavy fumes of sulphurous acid. I do not think that part of the silver chloride of the first roasting was decomposed by passing a second time through the furnace, but I am more inclined to believe that the dropping of the chlorination in the shaft was principally caused by mechanical separation. Part of the lighter ore particles which contained less lead and were better chloridized in the first roasting was carried over into the flue during the second roasting, thus seemingly reducing the original percentage of chlorination. Besides part of the silver chloride may have slagged during the second roasting.

There are, however, other circumstances which also act disadvantageously. For instance, I found that after the first roasting the ore in the shaft contained 8·48 per cent unoxidized sulphur and 11·19 per cent lead, while that from the descending flue contained only 0·51 per cent unoxidized sulphur, and 3·11 per cent lead. This shows that a separation takes place, the shaft receiving the main portion of the lead, while the lighter minerals, amongst it the iron pyrites, are carried over into the descending flue. The better oxidization and chlorination, as well as the high temperature in the flue, are principally due to this separation. But as the main bulk of the ore drops through the shaft such a separation is disadvantageous.

Another interesting fact I have to record. Using so much salt, and obtaining only such an imperfect oxidization and chlorination, we would naturally expect to find most of the salt undecomposed in the ore. This, however, is not the case. In the shaft the ore contained only 1·38 per cent chlorine, of which 0·8 per cent was combined with sodium, representing only 1·30 per cent undecomposed sodium chloride. The material from the first dust chamber contained 0·38 per cent of chlorine, of which 0·16 per cent was combined with sodium representing only 0·27 per cent sodium chloride, while the material from the descending flue contained but 0·2 per cent chlorine. The fine white dust from the last dustchamber contained 0·42 per cent chlorine and a great deal of sulphuric acid. The salt therefore was decomposed and the chlorine escaped as gas without effect, and we find the ore in a worse condition for further treatment after roasting than it was in its raw state.

Another bad feature is the formation of lumps. In the upper region of the shaft, the ore-dust, wherever it comes in contact with the hot walls, sticks to and incrusts them. This crust peels off and drops down in pieces. It is almost raw, and some of the larger pieces, when broken, show the texture of matte. They form in large quantities. When I had the ore sifted for re-roasting, there was not less than 25 per cent of the whole ore in the shape of hard lumps. These lumps contain only 21·87 ounces silver per ton, and 0·82 per cent chlorine, of which 0·28 per cent is combined with sodium, equal to 0·46 per cent sodium chloride.

Besides the chemical difficulties, I encountered a very annoying mechanical one. The ore-dust, in the same way as it incrusted the walls of the shaft, also incrusted the lower side of the screen of the feeding machine, and thus stopped up the holes, which necessitated a frequent changing of the screen, as often as twice a day.

Heavily sulphureted ores, especially if they carry zinc, require more draft in roasting than less sulphureted ores. This is especially the case with the Stetefeldt furnace, where the ore is exposed only for such a short time to the action of air and heat. In compliance with this theory I opened all the air doors with which the furnace is provided, but the result did not improve.

The chloridized ore contained in the shaft 8·48 per cent sulphur, and in the descending flue 0·51 per cent, while the ore subjected to an oxidizing roasting contained in the shaft 7·60 per cent and in the flue 0·30 per cent sulphur.

After having convinced myself that the Stetefeldt furnace could not chloridize the "Del Oro" ore, even if it was left on the cooling floor in heaps until it was cool, and after nearly all my hands in the mill got sick from the sulphurous acid fumes which continued to be emitted for several days from each pile on the cooling floor, I stopped further experiments. The fact, however, that the Stetefeldt furnace oxidized the main portion of the sulphur, made the idea feasible to use this furnace as an oxidizer, and finish the roasting with an addition of salt in the Howell or in the reverberatory furnace. By such a combination the capacity of the latter furnace would have been greatly increased, and I made, therefore, some experiments in this regard. Besides, the large piles of insufficiently roasted ore had to be brought into a fit condition for reduction.

The results obtained in these experiments I give in the following paragraph.

REROASTING THE ORE OF THE STETEFELDT FURNACE IN THE MODIFIED HOWELL FURNACE.

By modified Howell furnace I mean a Howell cylinder furnace to which a reverberatory is attached and which I will describe further below.

The partly roasted ore from the Stetefeldt furnace, after sifting was fed into the Howell furnace. Having previously ascertained that the ore contained only 1·3 per cent of salt, I added 6 per cent and sometimes 8 per cent more salt. I changed from time to time the rate of feeding in order to test the working capacity of the cylinder for this ore; thus the rate varied from 5 to 9 tons per 24 hours. The following results are the averages of 33 charges.

Average of reroasted ore, 31·42 ounces silver per ton; average of leach tailings, 17·55 ounces per ton; average of chlorination, 44·2 per cent.

The consumption of wood in reroasting proved to be much greater than in roasting the raw ore. The main portion of the sulphur, especially that of the pyrites, which easily ignites, having been burned off in the Stetefeldt furnace, the ore did not create any heat by itself, and all the required heat had to be furnished. To reroast 8·3 tons it took 26 cargas of wood (12 cargas=1 cord) while it took only 16 cargas to roast 10 to 11 tons of raw ore. Besides the roasting capacity of the furnace was not increased as expected, but on the contrary was diminished. If we take into calculation the amount of wood previously used in the Stetefeldt furnace, the consumption was more than double. But this is not the main objection, because the red hot ore from the Stetefeldt furnace could have been dumped directly into a reverberatory and the consumption of wood during the finishing roasting materially lessened. What made this plan impracticable was found in the fact that the ore by passing through the Stetefeldt furnace underwent such a change that it was impossible to obtain afterwards an acceptable chlorination.

The reroasted ore was of a red brown color, smelled of chlorine, and did not emit any sulphurous acid gas, but it still consisted principally of little globules of which I spoke above. Quite a large portion of the globules remained black, no matter how long the ore was kept in the furnace. Some of them were magnetic, but the majority were not. Between the fingers the reroasted pulp felt sharp like pulverized glass. The temperature was kept at a proper degree, and the dust chambers and furnace having been previously cleaned, there was an abundant draft, still it was not possible to obtain more than 44·2 per cent chlorination. The cause of this failure was undoubtedly the silicates which were formed during the roasting in the Stetefeldt furnace.

APPLYING STEAM WHILE REROASTING THE ORE FROM THE STETEFELDT FURNACE IN THE MODIFIED HOWELL.

A jet of steam was introduced into the reverberatory of the modified Howell. The hydrochloric acid which had been formed by the action of the steam was of a decidedly beneficial influence, and considerably improved the result, still the result did not give sufficient satisfaction. I used the same percentage of salt and maintained the same temperature as in the foregoing experiments, and the improved results are therefore exclusively due to the action of the steam. The following figures are the average of thirteen charges.

Average of re-roasted ore, 31.0 ounces per ton; average of leach tailings, 10·37 ounces per ton; average of chlorination, 66·6 per cent.

The ore still contained a considerable amount of these little globules, but they had changed their color to red brown, and between the fingers the ore felt soft and not so sharp and glassy as when roasted without steam.

COST OF ROASTING IN THE STETEFELDT FURNACE.

It is hardly proper to give a statement of cost, as the ore was only partially roasted and not fit for further treatment.

The consumption of wood was exceedingly small, but that of salt rather large. Twelve per cent of salt gave the highest chlorination. Assuming that the Stetefeldt furnace could roast the ore of the San Francisco del Oro mine, its working capacity would not be more than about 20 tons. I could not roast that amount successfully, and therefore I am not justified in assuming a larger working capacity than that.

Even if more than 20 tons per day could be roasted the cost would not be much reduced, as the salt alone at 1·27 cents per pound amounts to $3 per ton.

CONCLUSIONS.

My experiments in roasting the ore of the San Francisco del Oro mine in a Stetefeldt furnace have shown:

1. An incomplete oxidization of the sulphureted minerals, the main portion of the ore still containing 8·48 per cent unoxidized sulphur when roasted with salt, and 7·6 per cent when roasted without salt.

2. An insufficient chlorination of the silver. The highest chlorination of the ore in the shaft was only 16·9 per cent, and as 62·5 per cent of the whole volume of the ore dropped into the shaft, the somewhat higher chlorination obtained in the descending flue could not much improve the average chlorination.

3. That the principle of the Stetefeldt furnace is contrary to the conditions, the maintenance of which are so essential to roasting ores containing much zincblende and galena. Instead of permitting the ore to be subjected for a longer time to a gradually increasing temperature, the ore, entering the furnace, encounters immediately the highest temperature, which is detrimental to the roasting of such ores.

4. That on account of the sudden exposure of the raw ore particles to such a high temperature they melt to minute globules, which make the ore unfit for further treatment.

5. That a concentration of the lead minerals takes place in the shaft, which is disadvantageous.

6. That about 25 per cent of the ore when passing through the furnace is changed into hard lumps of almost raw ore.

7. That the lower side of the feeding-screen becomes rapidly incrusted and the holes obstructed, requiring a too frequent exchange of screens.

These observations taken together prove beyond doubt that the Stetefeldt furnace is not suitable for the San Francisco del Oro ore, and consequently, I assume, neither for any ore heavily charged with zincblende and galena.

ROASTING IN THE HOWELL FURNACE.

The furnace which I used was not a regular Howell. It consisted of a revolving cylinder of uniform diameter, the shell being made of boiler

iron and lined with bricks the whole length. The principle on which it works, however, is identical with that of the Howell, and I use this name merely to indicate the type of furnace.

The Howell, like the Stetefeldt furnace, requires the salt to be mixed with the ore before entering the furnace. With some ores this is immaterial, but it is a point of the greatest importance for the Del Oro ore. If the salt is previously added the ore becomes sticky, incrusts the furnace rapidly, and when it leaves the furnace consists mostly of lumps without being much chloridized. If the ore is charged without salt, it remains dry and sandy, but a very annoying separation takes place. The fine particles are carried by the draft into the dust chambers, and only the coarse sand passes through the furnace, without being sufficiently desulphurized. If then salt is added in the drop pit, only a small percentage of the silver becomes chloridized. The best results gave only 29 per cent chlorination.

In order to diminish the separation, two per cent of salt were added to the ore in the battery, while the balance of the salt was added in the drop pit. This small percentage of salt made the ore sticky enough to diminish considerably the dusting, without causing the formation of lumps or too heavy an incrustation of the furnace.

By this mode of roasting the chlorination improved considerably, the average of three days' run being 67 per cent. I soon, however, convinced myself that the Howell furnace, as such, could not roast the Del Oro ore. The results were not uniform and reliable, sometimes high, sometimes low, and, notwithstanding the greatest care, the average could not be brought above 67 per cent. But the roasted ore was in a good condition; it was unfinished but not spoiled, as in the Stetefeldt furnace, and I had reason to expect that by an alteration which gave the ore more roasting time and allowed a better regulation of the temperature, good results would be obtainable.

ROASTING IN THE MODIFIED HOWELL FURNACE.

In front of the furnace I constructed a shallow drop pit and a fireplace. To one side of the drop pit and communicating with the same I attached a small reverberatory furnace, 6 feet by 8 feet, the bottom of both being on the same level. The reverberatory contained one working door and a 24-inch fireplace. When enough ore had accumulated in the pit to make a charge for the reverberatory, it was pushed by means of a hoe into the reverberatory. Each charge consisted of about 1400 pounds. While starting the furnace a strong fire was kept in both fireplaces, but after the process was in operation the fire in front of the cylinder was much lowered; in fact, so much so that half the grate-bars remained bare of wood. Only now and then a thin stick of wood was added, just enough to prevent the drop pit from getting chilled. Two per cent of salt were added to the ore in the battery.

If the roasting is properly conducted, the blue flame of the ignited pyrites can be observed in the back part of the cylinder. Next to it, and reaching beyond the middle of the cylinder, the ore assumes a higher temperature, forming a belt of bright red heat. The part of the furnace next to the fire and nearly one third of the whole length has to look dark. The furnace is mostly heated by the combustion of the sulphides, and receives but little supply from the fireplace and from the reverberatory. In fact, the ore while in the cylinder should be left as much as possible to roast in its own heat. This is a very important condition to maintain. The object is to convert as much as possible of the galena and zincblende into sulphates and oxides before generating chlorine, and to avoid until then as much as possible the decomposition of the iron salts. This can only be done by maintaining a low heat after the combustion of the pyrites. An excess of heat is invariably connected with an excessive loss of silver by volatilization and by a low chlorination. Galena and zincblende roast quicker and better in a low than in a high heat. When the ore leaves the cylinder and drops into the pit it should be of a very dull red heat, while the color after cooling should be dark yellow-brown.

If the temperature is so kept, neither the odor of chlorine nor much of sulphurous acid can be detected. At an increased heat, sulphurous acid emits again strongly, showing that the oxidization is not completed yet. As the temperature in the cylinder is mostly produced by the combustion of the sulphureted matters, the main means of regulating the same is the feed. If too much ore enters the furnace the belt of bright read heat increases, advancing more and more towards the front, and finally the whole furnace assumes this temperature. The ore dropping into the pit is very hot, emits heavy fumes and overheats the pit. If then removed into the reverberatory, it takes a very long time to be finished, necessitating an interruption in the feed of the cylinder. On the other hand, if not sufficient ore is charged, the belt of bright red heat gets smaller and moves towards the back end of the furnace.

When the properly prepared ore enters the reverberatory furnace the salt is added and the temperature increased. It commences to fume, and swells, without forming more lumps than an ordinary ore. In the beginning strong fumes of sulphurous acid emit, but soon cease, and chlorine appears. The charge is finished if the fumes assume a mild and sweetish smell of chlorine; as long as they smell strong, roasting has to be continued.

I made a series of experiments to ascertain the smallest amount of salt practicable, and found that 4, 6, 8 and 10 per cent give about equal results. Twelve per cent commences to make the ore too sticky and produces less chlorination; 3 per cent is sufficient if the roasting is very carefully conducted, but then only 1 per cent has to be added in the battery and 2 per cent in the furnace. Four per cent, however, is safer, as then the result does not depend so much on the skill and good-will of the laborers.

The roasting capacity of the furnace proved to be much less for this ore than for ordinary ore. I could not roast more than 8½ tons in 24 hours. It is true the cylinder was only 24 feet long, but even with a 32-foot cylinder I do not expect to roast more than 12 tons per day. Each charge had to remain two hours on the reverberatory hearth. Though the ore was roasted in the reverberatory at a somewhat increased heat, yet the temperature could not be increased beyond dull red without losing too much silver by volatilization.

COARSE CRUSHING VS. FINE CRUSHING.

If the silver bearing minerals of an ore are not of great density and decrepitate in the heat, the ore can be crushed coarse without endangering the result of the subsequent roasting. But if the principal silver-bearing mineral, like the zincblende in the Del Oro ore, is of great density and does not decrepitate, it is of the greatest importance to crush fine. I made a series of roasting experiments with ore crushed through No. 20 and No. 40 screens, and found the ore crushed through No. 20 to require a much longer time and to be 27 per cent less chloridized than the ore crushed through No. 40. The material which passes through a battery screen of a certain number is much finer than the size of the meshes. Heavy ore makes a much finer pulp through the same screen than lighter ore. I sifted the pulp of the Del Oro ore obtained by crushing through battery screens No. 20 and No. 40 through sieves of different fineness, and obtained the following figures:

Battery pulp when sifted through sieve No.	Crushed through B. screen No. 20. Percentage of material *passing* through the sieve.	Crushed through B. screen No. 40. Percentage of material *passing* through the sieve.	Crushed through B. screen No. 20. Percentage of material *remaining* on the sieve.	Crushed through B. screen No. 40. Percentage of material *remaining* on the sieve.
No. 30	93·8	100	6·2	0·0
No. 40	87·3	100	12·7	0·0
No. 60.....	78·8	98·95	20·2	1·05
No. 80.....	71·2	93·80	28·7	6·20
No. 90	67·1	90·50	32·9	9·50

These figures show how exceedingly fine a heavy ore is crushed in a battery, even through a screen with comparatively coarse meshes. Though 67·1 per cent of the material which was crushed through screen No. 20 were finer than sieve No. 90, the average chlorination of quite a number of comparing roastings was 27 per cent less than that of ore crushed through battery screen No. 40. This indicates how essential it is to crush such ores fine.

Rolls produce a pulp more uniform in size, and a much larger percentage of it corresponds in size with the size of the meshes of the revolving screen. Now I found that in order to chloridize well, the Del Oro ore had to be crushed through battery screen No. 40, which furnished a pulp of which only 9½ per cent was coarser than sieve No. 90. To produce such a fine pulp with rolls would require so exceedingly fine screens, that the use of them would be impracticable. Such fine crushing, however, is necessary for certain ores, and it is therefore not prudent to recommend or adopt rolls regardless of the nature of the ore. I surely cannot recommend them for the San Francisco del Oro ore. I am well aware that for certain kinds of ore, rolls are superior to stamps, but we must not blindly accept a pulverizing machine on account of certain advantages without first carefully investigating whether the ore pulp produced

WORKING RESULTS OBTAINED IN ROASTING EXPERIMENTS WITH THE MODIFIED HOWELL FURNACE.

DATE, 1888.	Per cent of salt used.	Value of raw ore.	Value of raw ore containing salt.	No. of tank charge.	Value of roasted ore.	Value after leaching in the laboratory.	Per cent of chlorination when the ore left the furnace.	Value of vat tailings.	Per cent of actual chlorination calculated from the vat tailings.	Loss in weight the ore sustained during roasting.	Loss of silver by volatilization.	Loss of silver by tailings.	Per cent of chlorination gained in the vat.	Per cent of actual silver extraction.	Number of ounces silver extracted.		Remarks.
		Oz. per ton.	Oz. per ton.		Oz. per ton.	Oz. per ton.	Per cent.	Oz. per ton.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per ton.		
April 20.....	5½	34·21	32·33	9	31·34	11·66	37·2	7·75	75·3	2½	5·2	24·5	38·1	70·3	24·04	*	} Assorted ore.
" 21.....	6	34·50	32·43	10	30·91	9·04	71·8	7·26	76·6	2½	7·1	21·8	4·8	71·1	24·52		
" 23.....	5	35·09	33·34	11	31·49	8·89	71·8	4·33	84·7	2½	7·8	14·1	12·9	78·1	27·40		
" 24.....	5	33·76	32·07	12	29·74	8·16	72·6	3·29	89·0	2½	9·5	10·0	16·4	80·5	27·17		
" 25.....	5	31·67	30·09	13	29·59	6·99	76·4	3·57	88·0	2½	4·1	11·5	11·6	84·4	26·72		
" 26.....	5	29·09	28·64	14	29·16	7·58	74·0	4·25	85·5	3½	1·7	14·3	11·5	84·4	24·55		
" 27.....	4½	27·35	26·02	15	25·95	13·27	51·9	4·25	84·7	3½	3·7	15·7	32·8	80·6	22·04	*	} Ore slightly assorted.
" 28.....	4	28·32	27·19	16	24·49	12·89	47·4	4·48	81·8	3½	13·0	15·8	34·4	71·2	20·16	*	
" 29.....	4	26·02	24·98	17	22·16	4·95	77·7	4·76	78·7	3½	14·2	19·0	1·0	66·8	17·38		
" 30.....	5	25·43	24·42	18	22·74	5·24	77·0	4·48	80·3	3½	10·1	18·3	3·3	71·6	18·20		} Unassorted ore, just as it was broken down in the mine.
May 1.....	5	24·37	23·15	19	21·57	4·66	78·4	4·84	77·6	3½	10·0	20·0	0·8	70·0	17·05		
" 2.....	5	23·94	21·97	20	22·45	5·39	76·0	3·87	82·8	3½	1·3	17·0	6·8	81·3	19·46		
" 3.....	4	24·28	23·31	21	22·01	5·83	73·6	4·84	78·1	3½	8·7	20·0	4·5	71·3	17·31		
" 4.....	4	26·02	24·98	22	21·87	6·12	72·1	4·30	80·4	....	15·5	16·6	8·3	67·9	17·66		
	4·7	28·85	27·44		26·10	7·90	68·4	4·76	81·6	3	7·9	17·0	13·3	74·9	21·69		Averages.

Charges marked * were treated during base-metal leaching with cupric acid.

by such a machine is in a suitable condition for further treatment or not.

The crushing capacity of the battery was not much diminished by using No. 40 screen instead of No. 20, principally because the ore is so heavy. For comparison I had during 12 hours 5 stamps crushing through No. 20 and 5 stamps through No. 40, and found:

	Pulp.
No. 20 without salt furnished	8,100 lbs.
No. 40 with 4 per cent salt furnished	7,488 "
Difference in favor of coarse	912 " in 12 hours.

or 7½ per cent, a very small reduction in the crushing capacity, if we compare it with the great advantage gained by it for roasting.

ADDITIONAL CHLORINATION OF THE SILVER AFTER THE ORE HAS LEFT THE FURNACE.

Some ores gain much in chlorination of the silver if left hot in a pile for several hours. This is mostly the case when an ore is insufficiently roasted, or when the nature of the ore is such as to require a long roasting at a low heat. Another additional chlorination can be produced by moistening the ore and leaving it for several hours in a pile. This is usually the case if the ore contains copper. Roasted ore containing caustic lime should not be left moist on the cooling floor. The most important additional chlorination, however, takes place according to numerous observations I made, during base-metal leaching. In Silver King, Arizona, this additional chlorination amounted to nearly 6 per per cent. The roasted Del Oro ore contained much caustic lime, and I could not wet it on the cooling floor without decomposing some of the silver chloride. I filled, therefore, the vat before charging, about one third with water, and dumped the hot ore into it, thus producing a hot base-metal solution, and made the observation that by it not only the decomposition of the silver chloride was avoided, but that a considerable increase in the silver chlorination took place, in some instances as much as 12·9 per cent (see following table, charge No. 11.) If the original chlorination, however, was 75 per cent or more, this additional chlorination amounted to much less. By adding some cupric chloride to the water in the vat before dumping the ore in, I found that badly roasted charges gained in chlorination as much as 34–38 per cent (see table, charge Nos. 9, 15 and 16).

These are very important observations and give the operator the means of correcting badly roasted charges.

RESULTS.

The table is a careful record of the results obtained in roasting the San Francisco del Oro ore in the modified Howell furnace. It represents a two weeks' run. As each tank charge contained the whole ore of 24 hours' roasting, it offered a good opportunity to follow each charge from the raw ore down to the tailings, and to ascertain for each charge the loss by volatilization, gain by additional chlorination, etc.

(TO BE CONTINUED.)

Rare Metals and Their Uses.—Some rare metals, possessing special qualities, are required for certain work. Thus palladium is used in making some parts of timepieces, and irridium for the points of gold pens, and the uninitiated have no idea of the value of such scarce products. Vanadium costs, for instance, 123,900 francs per kilogramme; zeconium, 79,295 francs, and lithium, which is the lightest of metals, 77,090 francs per kilogramme. Rhodium, which is extremely hard and brittle, and is only fusible at a very high temperature, fetches 25,330 francs; and irridium, the heaviest substance hitherto discovered, costs 12,005 francs per kilogramme. It will therefore be seen that gold and silver are far from being the most precious metals as far as their market value is concerned.

A New Electrometer.—M. Curie has recently brought before the Physical Society of Paris a new electrometer, devised by himself in conjunction with M. Blondlot, and made by M. Ducretet. It is a modification of the ordinary quadrant electrometer, but the needle, instead of being in one piece made in the shape of a figure 8, consists of two semi-circular segments of corrugated aluminum foil, mounted upon and insulated from each other by an ebonite bar, to the center of which is attached the suspending fiber. The ordinary quadrants are replaced by two semi-circular magnetized steel plates, so as to introduce a damping effect, and make the needle almost dead beat. The theory of the instrument as given by M. Curie differs from that of the ordinary quadrant electrometer in so far as the two halves of the needle must be at different potentials, and the fixed plates, which are symmetrically arranged, must also be at different potentials to obtain a deflection. Calling D the potential difference between the fixed plates, and d that between the two halves of the needle, the angle of deflection is $\alpha = K D d$, where K is a constant of the instrument.

The Cowles' Patents Sustained in Germany.—On November 29th, 1888, a final decision was rendered in the Imperial German Patent Office sustaining the Cowles Brothers' patented processes for the production of aluminum and other alloys. Dr. H. Kunheim, of Berlin, was the complainant, and made a motion to annul the Cowles German patents, Nos. 33,672, 34 730, 35 579, on the grounds of their being anticipated by the following references, viz.: Sir C. William Siemen's English patent of 1879, and the other publications regarding the same; English patent granted to Benzon, No. 2753, of 1858; the English patents granted to Camille Alphonse Faure in 1882 and 1883; John Calvert, patent of 1856, and many others. The office decided that in none of the citations were the processes anticipated, and the request for nullification on the part of Dr. Kunheim was, therefore, groundless.

It may be noted that the so-called Herault process is not patented in Germany. Their works were located in Switzerland a year ago, prior to the adoption of patent laws by that country, and it may be inferred that the above attack was instigated by the promoters of this latter steal of an American invention.

The Deterioration of Copper Wire by Electric Currents.—*La Lumière Electrique* reports that M. Firmin Larroque is carrying out a systematic investigation to determine the deterioration of copper by the long-continued action of electric currents, and his experiments have already been four years in progress. M. Larroque has examined some wire taken from a lighthouse, which had been in use over twenty years; he found that its surface was pulverulent; it was easily broken by a hammer, and its texture was granular; in fact it presented many of the properties of ordinary electrolytically-deposited copper. In another case in some wire taken from a secondary of a Ruhmkorff coil, and which had therefore been subjected to alternating currents, the deterioration was even more marked. The coil could not be unwound without repeated fracture, and its resistance had increased by no less than 30 per cent. In this case, also, the texture resembled that of electrolytic copper. M. Larroque's experiments are being conducted in the following manner: He has taken thirty-six strips of copper each ten millimeters in width and three millimeters in thickness (the length is not given). One half are bent into spirals and the other half into zigzags, and some are annealed and some hard drawn. They are suspended from a frame, and kept stretched by weights of 10 grams attached to the lower ends. Each strip is traversed by a current varying from ·5 ampères to 2 ampères, which has been maintained constant since the commencement of the experiment. The current is alternating (at the rate of 75 reversals per second) in one set, and continuous in another. From time to time an exact measurement of the elongation of the spiral is obtained, and this is taken as a measurement of the loss of elasticity of the metal. For the first eight or nine months no effect was observed, but after that a slow elongation became manifest. The amount of elongation in the different specimens increased with the current, and was more marked with the alternating than with the continuous currents.

Elastic Foundations for Dynamos.—As dynamos and steam engines are being introduced more and more into private houses and in neighborhoods where the vibration occasionally accompanying their operation is objectionable, some means for preventing the trouble is of special interest at this time. Various forms of foundations have been proposed for this purpose, very few of which, if any, have proved satisfactory. In a recent communication to the Société des Ingénieurs Civils, M. G. Anthoni describes a method of overcoming the difficulties caused by vibration and noise from engines, and the point upon which he lays special stress is, in the case of machinery, the increase of the mass of the system to be isolated and its carriage by an elastic body, such as rubber.

A large trench is dug out, at the bottom of which is placed planking surmounted by a covering of sheet-iron, on which are distributed a number of rubber cylinders, constituting at the same time an elastic and electric insulation. On top of these cylinders there is placed a second plate of sheet-iron, riveted to a framework so as to give stiffness to the whole. On this is built a foundation in the usual way, provision being made for the foundation bolts, and sufficient space being left to properly allow of periodically cleaning the trough of any extraneous matter, without disturbing the elastic suspension. The foundation need not be of masonry, and in some cases it might be advantageous to replace it by a caisson filled with sand, which may be easily transported. The trench surrounding the foundation is covered at the top by a plank forming a border, but so as to allow of horizontal movement. The steam and exhaust pipes are given a spiral turn at their upper ends so as to permit of their being elastic under the movement which takes place, and so as to avoid the springing of joints. In the particular case referred to, the oscillatory movement is eight millimeters, and nothing is more curious than to see this whole mass, which weighs more than twenty-five tons, rapidly vibrating without one being able to feel the slightest vibration even at the edge of the trench.

PATENTS GRANTED BY THE UNITED STATES PATENT-OFFICE.

PATENTS GRANTED FEBRUARY 12TH, 1889.

397,491. Process of Manufacturing Iron or Steel. Eugene H. Cowles, Cleveland, Ohio.
397,506. Transmitting Power. Timothy W. Lemieux, Duluth, Minn.
397,507. Regulator for Compound Engines. Charles T. Main, Lawrence, Mass.
397,516. Rotary Steam Engine. Daniel E. Powers, New York, N. Y., Assignor of one half to George W. Fuller, same place.
397,517. Method of Working Hydrocarbureted-Air Engines. William D. Priestman and Samuel Priestman, County of York, England.
397,520. Mechanicism for Converting Motion. Francis Rourk, London, Ontario, Canada.
397,523. Compound for Preventing Boiler Incrustation. Almason J. Scofield, Beloit, Wis., assignor to William A. Knapp, same place.
397,538. Electric Meter. Henry H. Cutler, Newton, Mass.
397,542. Ore Separator and Amalgamator. Eugene L. Giroux, Albina, Ore.
397,547. Incrustation Preventative. Burnett M. Henney, Springfield, Ill.
397,550. Dynamo-Electric Machine. Rudolph M. Hunter, Philadelphia, Pa.
397,553. David B. Oliver, Allegheny, Pa.
397,565. Blow-Off Apparatus for Steam-Boilers. Andrew W. Quackenbush, Moberly, Mo.
397,573. Volumetric Gas Regulator. Moses G. Wilder, Philadelphia, Pa.
397,581. Ore Washer. Henry G. Blasdel, San Francisco, Cal.
397,585. Combined Separator and Concentrator. John D. Coplen, Denver, Colo.
397,623. Carriage for Direct-Acting Rock-Drills. Gustav A. Barth, St. Louis, Mo., assignor to Pierre Chouteau, same place.
397,639. Apparatus for the Manufacture of Gas. John C. Garvin and Henry Moody, Leadville, Colo.
397,688. Mining Caisson. Silas A. Bowe, Huron, Dak.
397,699. Alloy. Eugene H. Cowles and Alfred H. Cowles, Cleveland, Ohio.
397,702. Electric Motor. Julian F. Denison, New Haven Conn.
397,707. Rotary Steam Engine. Zenas R. Farrington, Portland, Me.
397,712. Machine for Bending Pipe. Herbert E. Fowler, New Haven, Conn.
397,713. Machine for Bending Pipe. Herbert E. Fowler, New Haven, Conn.
397,724. Machine for Rolling Seamless Tubing. Charles Kellogg, Buffalo, N. Y., Assignor to the Kellogg Seamless Tube and Manufacturing Company, Boston, Mass.
397,743. Process of Manufacturing Steel. James J. McTighe, Pittsburg, Pa.
397,972. Process of Extracting Oil. Walter T. Forbes, Atlanta, Ga., and George Leder, Demopolis, Ala.
397,793. Machine for Bending and Coiling Pipe. Herbert E. Fowler, New Haven, Conn.
397,795. Storage Battery Plate. Charles D. P. Gibson, New York, N. Y.
397,805. Automatic Pressure-Regulating Valve. Warren S. Johnson, Milwaukee, Wis.
397,827. Carriage for Direct-Acting Rock Drills. Gustav A. Barth, St. Louis, Mo., assignor to Pierre Chouteau, same place.
397,841. Grading and Ditching Machine. George B. Durkee, Chicago, Ill., Assignor to Frederick C. Austin, same place.
397,846. Amalgamator. Thomas F. Freeman, Brooklyn, N. Y.
397,849. Stone Ore Conveyer. Philetus W. Gates, Chicago, Ill.; Ralph I. Gates, Administrator of said Philetus W. Gates, deceased.
397,860. Machine for Molding Tubes or Cylinders. Henry G. Keasbey, Ambler, Assignor of one half to Richard V. Mattison, Philadelphia, Pa.
397,875. Overhead Line for Electric Railways. Frank J. Sprague, New York, N. Y., Assignor to the Sprague Electric Railway and Motor Company, same place.
397,882. Plunger-Rod for Pumps. Walter C. Westaway, Decorah, Iowa.

THE METALLURGY OF STEEL.*

By Henry M. Howe.

(*Continued from page* 145.)

It is stated that the segregation occurs at a lower point in bottom- than in top-poured ingots, which would indicate that it tends to move to the last-freezing point.

The results given in Table 96, most of them here published for the first time, show how serious the irregularity of composition may be. W. Richards[a] states that, with carefully checked analyses, the carbon in his large ingots varies by from 0·10 to 0·15%: while J. Riley[b] states that the variation of carbon is not infrequently nearly 0·50% in one and the same ingot.

While segregation may occasionally be harmless or even beneficial, *e. g.* by concentrating the impurities in the neutral axis of the piece where little or no strength is needed, or by concentrating them in the ingot-top, which is subsequently cut off as in case of gun-ingots, it is doubtless usually injurious. Heterogenous composition usually implies heterogeneous strength and ductility: and the strength of a heterogeneous substance is usually nearer the strength of the weakest component or part than the average of all the parts: the piece tends to break down piecemeal. So with ductility.

§ 265. THE CAUSES OF SEGREGATION IN STEEL INGOTS.—The same forces which lead to the differentiation of cooling steel into the minerals already described (§ 237, p. 163) and of solidifying rock-magmas into the complex crystalline granite, doleryte, etc., are probably the cause of the segregation in cast-iron, in steel, and in alloys in general. There is the struggle between crystalline force and surface tension aided by gravity, on the one hand, tending towards differentiation, and of diffusion on the other, tending towards uniformity.

As the temperature sinks towards the freezing-point, surface tension probably increases, the different components tend less powerfully to diffuse among each other and more to draw apart in drops, as oil separates from water, the lighter to rise, the denser to sink. Further, as the complex molten mass cools past the freezing-point of a certain potentially present compound, into which certain elements might group themselves, this compound tends to form, to solidify, to crystallize, to expel the more fusible residue, as a salt crystallizing from an aqueous solution expels the mother liquor, which is gradually driven inwards towards the last-freezing region.

Now *time* is required to effect a considerable separation and segregation in either of these ways: whether to enable the lighter separated bodies to coalesce into masses of such size that they may rise readily by gravity, or to enable the first-freezing compounds to select and reject the more fusible ones, and to push them thus into the still molten interior: hence we infer that here, as in the solidification of other alloys, and in the crystallization of salts from aqueous solutions, slow cooling favors separation.

The masses which separate or segregate should be 1, compounds which differ much in fusibility from the rest of the mass: 2, compounds whose components have a strong affinity for each other, and which hence tend strongly to form during cooling: 3, compounds which differ greatly in density from the rest of the mass. Now slight differences in the composition or rate of cooling or of pressure may greatly change the resultant of the separating forces. Here one set of substances tends to form, and of this set one is light, fusible, and highly phosphoric; phosphorus segregrates markedly: there, the proportion of phosphorus remaining the same and that of some other element, say manganese, changing; or, the composition being constant, some change in crystallizing conditions tending to establish a different set of compounds, our light, fusible, phosphoric compound no longer forms, no segregation of phosphorus occurs. (Cf. p. 2, 2nd col.) Hence, while we confidently anticipate that a given element, say phosphorus, will tend most strongly to segregate when abundantly present, we may expect perplexing exceptions and contradictions.

The strong affinity of carbon, phosphorus and sulphur, as compared with that of manganese, for iron, and the greater fusibility and lower density of carbides, phosphides and sulphides than of manganese-iron alloys, should favor the segregation of carbon, phosphorus and sulphur as compared with manganese, and compensate more or less for the fact that the often much larger percentage of manganese than of these metalloids should favor the segregation of this metal.

With our present scanty information it were quackery to attempt a complete explanation of the instances of segregation at hand A glance at Figure 82 shows that borings taken from immediately adjoining points might give widely different compositions. As borings have almost necessarily been taken very blindly, we have here still another reason to anticipate very discordant results. In Figure 82 at least two different compounds seem to have segregated. Now, should one of these be highly phosphoric and the other not, our borings, should they penetrate only the non-phosphoric bunches, might falsely say that there was no segregation of phosphorus, nay, even that this element was chiefly concentrated in the mother-metal.

Again, while phosphorus increases the fusibility of iron greatly, it does not at all follow that when the mass splits up into a more and a less fusible part, the more fusible will always hold more phosphorus than the other. The elements group themselves in accordance with their chemical affinities, and it may often happen that the more phosphoric of two compounds may be the less fusible, the influence of its excess of phosphorus being outweighed by that of its excess, say, of carbon. So with the other elements.

But, though our results are as discordant as we could well expect, certain of their features deserve notice.

§ 266. WHAT ELEMENTS SEGREGATE MOST?—Of cast-iron we have hardly enough cases to justify generalization: let us therefore confine our attention to the steels, Table 96.

Phosphorus segregates in a greater proportion of cases than any other element, and, sparingly as it is present, it segregates on an algebraic average to a greater extent than any other element except carbon. As the influence of a given absolute quantity of phosphorus is so much greater than that of the other elements, so is its segregation much more important than theirs. Still, in no less than 13 out of the 59 cases the segregation contains less phosphorus than the mother metal, but in no case very decidedly less, its greatest deficit being less than 0·02%. In each of the four cases in which the phosphorus in the segregation exceeds that in the mother-metal by more than 0·11% there is also a very heavy segregation of carbon, in two of them a heavy segregation of manganese and in two a heavy segregation of sulphur. The segre-

* Copyright by the Scientific Publishing Company, 1887.

[a] Journ. Iron and Steel Inst., 1886, I., pp. 113-114.

TABLE 96.—SEGREGATION IN STEEL AND CAST-IRON.

Number.	Description.	Carbon. A. Mother-metal.	Carbon. B. Segregation.	Carbon. B — A.	Silicon. A. Mother metal.	Silicon. B. Segregation.	Silicon. B — A.	Manganese. A. Mother-metal.	Manganese. B. Segregation.	Manganese. B — A.	Phosphorus. A. Mother-metal.	Phosphorus. B. Segregation.	Phosphorus. B — A.	Sulphur. A. Mother-metal.	Sulphur. B. Segregation.	Sulphur. B — A.	Copper. A. Mother-metal.	Copper. B. Segregation.	Copper. B — A.	Slag. A. Mother-metal.	Slag. B. Segregation.	Slag. B — A.
	STEEL.																					
1.	R. Forsyth's Bessemer-steel rails. Bad rail....	·495	·495	0	·094	·126	+ ·032	1·744	1·643	— **·101**	·121	·130	+ ·009	·066	·075	+ ·009	·014	·017	+ ·003	·030	·138	+ **·108**
2.	.....	·473	·465	— ·008	·137	·128	— ·009	1·329	1·311	— ·018	·146	·161	+ ·015	·048	·045	— ·003	·075	·082	+ ·007	·054	·034	— ·020
3.	Good rail—wore well	·686	·865	+ **·179**	·041	·041	·000	·910	·915	+ ·005	·088	·124	+ ·036	·146	·217	+ **·071**	·075	·077	+ ·002	·022	·040	+ ·018
		·472	·409	— ·063	·086	·307	+ **·221**	1·064	1·135	+ ·071	·128	·120	— ·008	·126	·111	— ·015	·008	·007	— ·001			
4.	.....	·476	·411	— ·065	·086	·084	— ·002	1·055	1·036	— ·019	·128	·117	— ·011	·119	·116	— ·003	·008	·007	— ·001			
5.	.....	·475	·460	— ·015	·080	·087	+ ·007	1·043	1·018	— ·025	·129	·121	— ·008	·120	·110	— ·010	·002	·021	+ **·019**			
6.																						
7.	Good rail—wore well	·672	·737	+ ·065	·041	·043	+ ·002	·816	·831	+ ·015	·083	·099	+ ·016	·132	·173	+ ·041	·074	·073	— ·001	·022	·024	+ ·002
8.	Bad rail....	·380	·425	+ ·045	·026	·020	— ·006	1·085	1·080	— ·005	·144	·202	+ **·058**	·054	·084	+ ·030	·008	·011	+ ·003	·026	·056	+ ·030
9.	.....	·385	·513	+ **·128**	·026	·023	— ·003	1·056	1·131	+ ·075	·130	·207	+ **·077**	·059	·119	+ **·060**	·016	·014	— ·002	·024	·028	+ ·004
10.	.....	·367	·306	— ·061	·026	·032	+ ·006	·933	·916	— ·017	·090	·074	— ·016	·045	·034	— ·011	·244	·239	— ·005	·052	·076	+ ·024
11.	.....	·395	·387	— ·008	·036	·037	+ ·001	·858	·881	+ ·023	·106	·100	— ·006	·054	·049	— ·005	·005	·005	·000			
12.	Broke in testing..	·250	·700	+ **·450**	.....	.....	.....	·970	1·220	+ **·250**	·0728	·350	+ **·277**									
13.	.....	·392	·393	+ ·001	·023	·022	— ·001	·793	·778	— ·015	·084	·093	+ ·009	·044	·051	+ ·007	·133	·133	0	·032	·032	0
14.	Good rail—wore well	·366	·374	+ ·008	·107	·099	— ·008	·813	·768	— ·045	·147	·147	·000	·090	·087	— ·003	·053	·054	+ ·001	·016	·024	+ ·008
15.	.....	·314	·311	— ·003	·050	·114	+ **·064**	·801	·833	+ ·032	·107	·103	— ·004	·054	·050	— ·004	·031	·029	— ·002	·044	·032	— ·012
16.	.....	·323	·278	— ·045	·029	·048	+ ·019	·791	·789	— ·002	·086	·073	— ·013	·039	·029	— ·010	·041	·031	— **·010**	·028	·080	+ ·052
17.	.....	·304	·276	— ·028	·035	·042	+ ·007	·795	·804	+ ·009	·143	·136	— ·007	·033	·073	— ·010	·006	.....	.....	·040	·034	— ·006
18.	.....	·333	·445	+ **·112**	·028	·028	·000	·755	·892	+ **·137**	·081	·126	+ ·045	·029	·060	+ ·031	·005	·007	+ ·002			
19.	.....	·318	·319	+ ·001	·058	·063	+ ·005	·761	·758	— ·003	·102	·098	— ·004	·056	·055	— ·001	·043	·036	— ·007	·062	·068	+ ·006
20.	Bad rail....	·236	·305	+ ·069	·049	·126	+ **·077**	·795	·832	+ ·037	·094	·159	+ **·065**	·043	·104	+ **·061**	·013	·016	+ ·003	·020	·162	+ **·142**
21.	.....	·358	·315	— ·038	·035	·036	+ ·001	·672	·657	— ·015	·107	·098	— ·009	·048	·047	— ·001	·006	·006	0			
22.	Bad rail....	·301	·393	+ ·092	·034	·031	— ·003	·710	·853	+ **·143**	·145	·231	+ **·086**	·038	·079	+ ·041	·106	·105	— ·001	·022	·034	+ ·012
23.	.....	·284	·268	— ·016	·062	·048	— ·014	·717	·744	+ ·027	·101	·101	·000	·051	·054	+ ·003	·037	·036	— ·001	·030	·032	+ ·002
24.	Broke in testing..	·260	·360	+ ·100	.....	.....	.....	·720	·950	+ **·230**	·075	·160	+ **·085**									
25.	Good rail—wore well	·471	·462	— ·009	·475	·455	— ·020	·411	·413	+ ·002	·059	·062	+ ·003	·043	·047	+ ·004	·065	·056	— ·009	·030	·080	0
26.	.....	·248	·274	+ ·026	·019	·019	·000	·620	·646	+ ·026	·086	·109	+ ·023	·046	·060	+ ·014	·172	·186	+ **·014**	·030	·036	+ ·006
27.	Bad rail....	·252	·303	+ ·051	·008	·009	+ ·001	·604	·587	— ·017	·194	·240	+ ·046	·107	·143	+ ·036	·011	·013	+ ·002	·020	·020	0
28.	.....	·265	·268	+ ·003	·022	·029	+ ·007	·580	·662	+ ·082	·125	·135	+ ·010	·057	·080	+ ·023	·319	·343	+ **·024**	·028	·050	+ ·022
29.	Bad rail....	·235	·318	+ ·083	·016	·012	— ·004	·575	·583	+ ·008	·089	·135	+ ·046	·050	·101	+ **·051**	·049	·049	0	·074	·032	— ·042
30.	.....	·204	·183	— ·021	·010	·013	+ ·003	·570	·567	— ·003	·158	·139	— ·019	·065	·063	— ·002	·036	·014	— **·022**	·028	·044	+ ·016
31.	Failed in track...	·310	·600	+ **·290**	·089	·089	·000	·684	·792	+ **·108**	·1092	·2856	+ **·1764**									
32.	.....	·208	·178	— ·025	·025	·037	+ ·012	·492	·580	+ ·088	·122	·109	— ·013	·078	·072	— ·006	·011	·028	+ **·017**	· 044	·044	0
33.	.....	.....	.....	.....	.....	.....	.....	·360	·580	+ **·220**	·092	·193	+ **·101**									
34.	.....	.....	.....	.....	.....	.....	.....	·860	·830	— ·030	·115	·165	+ **·050**									
35.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	·126	·187	+ **·061**									
36.	Bessemer ingot.	·090	·100	+ ·010	·013	·015	+ ·002	.....	.....	.....	·086	·197	+ **·111**	·023	·078	+ **·055**						
37.	Tyre steel.....	·520	·590	+ ·070	·020	·070	+ **·050**	·500	·370	— **·130**	·080	·110	+ ·030									
38.	E. O'C. Acker. Boiler plate.	·110	.....	.....	.....	.....	.....	·390	·410	+ ·020	·017	·024	+ ·007	·021	·031	+ ·010						
39.	Boiler plate.	.....	.....	.....	.....	.....	.....	.....	.....	.....	·051	·072	+ ·021	·027	·052	+ ·025						
41.	13-ton ingot.	·150	·180	+ ·030	.....	.....	.....	·690	·720	+ ·030	·054	·087	+ ·033	·020	·039	+ ·019						
42.	Ingot.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	·016	·026	+ ·010	·014	·040	+ ·026						
43.	Ingot.....	·190	·300	+ **·110**	.....	.....	.....	.....	.....	.....	·048	·074	+ ·026									
45.	Steel rail.....	·270	·410	+ **·140**	·015	.....	.....	·860	.....	.....	·091	·283	+ **·192**	·078	·270	+ **·192**						
46.	Ingot, 90″ long	·370	·920	+ **·550**	·006	·043	+ ·037	·498	·585	+ ·087	·096	·261	+ **·165**	·025	·161	+ **·136**						
47.	Ingot, 7′ long...	·440	·770	+ **·330**	.....	.....	.....	·514	·558	+ ·044	·052	·142	+ **·090**	·040	·187	+ **·147**						
48.	" " "	190	·210	+ ·020	0	0	0	·360	·342	— ·018	·050	·068	+ ·018	·044	·056	+ ·012						
49.	" " "	·420	·420	·000	tr	tr	0	·738	·755	+ ·017	·044	·056	+ ·012	·039	·046	+ ·007						
50.	33″ steel roll....	·680	1·200	+ **·520**	·410	·410	0	·690	·840	+ **·150**	·074	·100	+ ·026									
51.	Steel plates, Eccles....	·115	·160	+ ·045	tr	tr	0	·576	·590	+ ·014	·038	·112	+ **·074**	·030	·073	+ ·043						
52.		·105	·155	+ ·050	tr	tr	0	·576	·655	+ ·079	·057	·106	+ ·049	·105	·239	+ **·134**						
53.		·115	·135	+ ·020	tr	tr	0	·518	·518	0	·044	·051	+ ·007	·041	·072	+ ·031						
54.		·150	·240	+ ·090	·010	·010	·000	·648	·614	— ·034	060	·127	+ **·067**	·054	·155	+ **·101**						
55.	19″ shaft.....	·452	·898	+ **·446**	·106	·123	+ 017	·690	·818	+ **·128**	·059	·139	+ **·080**	·014	·031	+ ·017						
56.	Bessemer steel tyres.	·286	·241	— ·045	·864	·944	+ **·080**	1·100	1·218	+ **·118**	·063	·068	+ ·005									
57.		·205	·205	·000	·305	·321	+ ·016	·594	·613	+ ·019	·103	·104	+ ·001									
58.		·294	·252	— ·042	·252	·240	— ·012	·545	·509	— ·036	·050	·073	+ ·023									
59.	Ingot.....	·775	·725	— ·050	·078	·023	— **·055**	·425	·306	— **·119**	·032	·014	— ·018	·027	·023	— ·004						
60.	Bar of Krupp steel.....	·852	1·020	+ **·168**	·130	·195	+ **·065**	·448	·425	— ·023	·044	·050	+ ·006	0	·005	+ ·005	·234	·224	— ·010			
61.		·30±	·780	+ **·480**																		
62.	Lividia boilers..	·095	·200	+ **·105**	.....	.....	.....	·331	·371	+ ·040	·039	·095	+ ·056	·086	·177	+ ·141						

SUMMARY OF SEGREGATIONS IN STEEL.

No. of + cases..	.....	.....		34	.....	.....	23	.....	.....	32	.....	.....	44	.....	.....	32	.....	.....	12	.....	.....	15
" — "	.....	.....		17	.....	.....	12	.....	.....	20	.....	.....	18	.....	.....	15	.....	.....	13	.....	.....	4
" 0 "	.....	.....		3	.....	.....	11	.....	.....	1	.....	.....	2	.....	.....	0	.....	.....	4	.....	.....	4
Maximum + case	.....	.....	+ ·550		.....	+ ·221	.....	.....	+ ·250	.....	.....	+ ·2772	.....	.....	+ ·192	.....	.....	+ ·024	.....	.....	+ ·142
Maximum — case	.....	.....	— ·065		.....	— ·055	.....	.....	— ·130	.....	.....	— ·019	.....	.....	— ·015	.....	.....	— ·022	.....	.....	— ·042
Algebraic av'ge	.....	.....	+ ·085		.....	+ ·013	.....	.....	+ ·025	.....	.....	+ ·038	.....	.....	+ ·032	.....	.....	+ ·0014	.....	.....	+ ·016
Arithmetr. av'ge	.....	.....	·100		.....	·019	.....	.....	·051	.....	.....	·043	.....	.....	·036	.....	.....	·0066	.....	.....	·023

CAST IRON.

101.	Gruson armor..	3·310	3·030	— **·280**	·260	·700	+ **·440**	1·930	1·080	+ ·050												
102.	Chilled.....	3·270	3·060	— ·210	·910	1·010	+ ·100	1·640	1 010	— **·630**												
103.	Grey-iron.....	3·975	3·409	— **·566**	3.653	3·679	+ ·026	1·580	1·320	— **·260**	·018	·005	— ·013	·027	·019	— ·008	·037	·027	— ·010	Arsenic.		
104.	.....	3·764	2·864	— **·900**	3·140	3·153	+ ·013	·852	·931	+ ·079	·885	·826	— ·059	·010	·018	+ ·008	·058	·051	— ·007	·0640	·134	+ **·070**
105.	Cleveland iron..	3·000	1·750	— **1·250**	1·630	·790	— **·840**	·355	·288	— ·067	1·530	6·840	+ **5·310**	·120	·060	— ·060						
106.	Spiegeleisen	4·391	4·808	+ ·417	·395	·260	— **·135**	6·120	6·570	+ **·450**	·525	·171	— **·354**									
107.		4·376	4·768	+ ·392	·521	·229	— **·292**	6·008	6·970	+ **·962**	·591	·378	— **·213**									
108.		4·283	4·627	+ ·344	·313	·101	— **·212**	5·872	6·380	+ **·508**	·561	·272	— **·289**									
109.	6-ton block..	3·202	2·940	+ ·010	·640	·760	+ **·120**	.....	.....	.....	1·318	1·346	+ ·028	·199	·007	— ·192	.....	.....	.....	Slag. 1·460	·920	— ·540
110.		2·930																				
	No. of + cases.	.....	.....	3	.....	.....	5	.....	.....	5	.....	.....	2	.....	.....	1	.....	.....	0	.....	.....	1
	" — "	.....	.....	6	.....	.....	4	.....	.....	3	.....	.....	5	.....	.....	3	.....	.....	2	.....	.....	1
	Maximum + case	.....	.....	+ ·417	.....	.....	+ ·440	.....	.....	+ ·962	.....	.....	+ 5·310	.....	.....	+ ·008	.....	.....	.....	.....	.....	+ ·070
	Maximum — case	.....	.....	— 1·250	.....	.....	— ·840	.....	.....	— ·630	.....	.....	— ·354	.....	.....	— ·192	.....	.....	— ·010	.....	.....	— ·540

Liquations.

115.	.....	3·411	3·069	— **·347**	2·044	1·635	— ·409	0·430	0·420	— 010	0·440	1·984	+ 1·544	0·086	0·052	— ·034	0·028	0·012	— ·016			
116.	Siegen cast-iron.	.....	.....	.....	.....	.....	.....	.....	.....	.....	·823	2·466	+ 1·643									
117.	.....	3·463	3·818	+ **·355**	2·196	1·869	— ·327	2·620	5·188	+ **2·568**	.....	.....	.....	·056	·223	+ ·167						
118.	.....	3 590	4·020	+ **·430**	1 790	3·150	+ **1·36**	·630	·870	+ **·240**	·620	2·130	+ **1.510**	·050	·050	0						

1 to **35.** R. Forsyth, private communication, Jan. 27th, 1886.

36. B. W. Cheever, Trans. Am. Inst. Min. Eng., XIII., p. 167. Bessemer-steel ingot 13″ × 13″ × 4′ 6″. Mother-metal = point at outside: segregation = axis 2′ 6″ from bottom.

37. Borings from metal originally at the outside (mother-metal) and originally at the center (segregation) of a 550 lb. open-hearth steel tyre-ingot. Zetsche, Stahl und Eisen, IV., p. 646, 1884. Also Jour. Iron and Steel Inst., 1884, II., p. 672.

38 to **43.** E. O'C. Acker, private communication, 1888.

38. ¾-inch boiler-plate rolled from 10″ × 18″ ingot: mother-metal = bottom-end of plate, segregation = middle. **39.** Bottom-end and middle of another boiler-plate. **40.** Test-ingot of heat, and point near top of a boiler-plate ingot 10″ × 18″ × 30″.

42. Open-hearth ingot, 10″ × 18″ × 30″ top-cast: mother-metal = points at outside: segregation = 4″ from top, in axis of ingot.

43. 26,000-lb. ingot, cf. Figure 81. Mother-metal = test-ingot of heat: segregation = a point in the axis near the top of the ingot.

46. F. Stubbs, Journ. Iron and St. Inst., 1881, I., p. 199. Ingot 7′ 6″ long: mother-metal = 2′ 6″ from bottom: segregation = 1′ 11″ from top.

47. Snelus, Journ. Iron and St. Inst., 1881, II., p. 379. After recarburizing with spiegeleisen the Bessemer converter was turned up and the blast sent through the metal for nearly a min-

gation-excess of phosphorus amounts to 0·05% or more in 17 out of the 59 cases given.

Sulphur.—The segregation of sulphur probably comes next in importance, though the greatest excess, 0·192%, is much less important than the maximum phosphorus excess, 0·277%. Out of the ten cases in which the segregation-excess of sulphur is 0·05% or more, there is a very considerable segregation of phosphorus in 7, of carbon in 5, of manganese in only one. This suggests that sulphur and phosphorus tend to segregate together. We may not infer, however, that this is untrue of sulphur and manganese. In nearly every case in which manganese segregates, a larger and usually a very much larger proportion of the sulphur present segregates along with it: and in very many cases the segregation-excess[a] of sulphur is larger absolutely than that of manganese, in spite of the relatively small proportion of sulphur present. As far as this goes, it harmonizes with the evidence in § 81, p. 43, showing that manganese tends to drag sulphur off.

Carbon.—The average segregation-excess of carbon is greater than that of any other element, and in five cases it exceeds 0·44%. The segregation of carbon when severe is usually accompanied by a severe segregation of some other element; but of now one, now another, without apparent rule. In 63% of the cases there is a greater or less segregation-excess of carbon: and in only 4 out of 54 is there a segregation-deficit of as much as 0·05%. When we turn to the cast-irons, however, the segregation-deficit of carbon is usually very severe. There is a segregation-deficit in every case except 106 to 108, and here we have reason to believe that what appears to be a segregation is really the first-solidified part, spanning subsequently-formed vugs.

Ledebur suggests plausibly that the segregation-deficit of carbon in case of cast-iron may arise because an increase of carbon beyond a certain point, say 3%, actually decreases fusibility: so that here the less carburetted compound is the more fusible, and hence segregates.

Manganese and Silicon.—In the cases here presented the segregation of manganese and of silicon is in general much less important than that of carbon, phosphorus and sulphur, in the case of silicon perhaps because little silicon is usually present, and in case of manganese for the reasons already given. Still, the segregation-excess of manganese reaches 0·128% in eight cases and 0·22% in three. We have only one very severe segregation-excess of silicon, 0·221% in Number 4.

Perhaps the worst cases are Numbers 12, the end of a rail rolled at Chicago in 1879, broken in testing, and showing a hard spot on head and web, with segregation-excess of 0·45% of carbon, 0·25% of manganese, and 0·277% of phosphorus: Number 46, a very large ingot reported by Stubbs, with a segregation-excess of 0·55% of carbon: and Number 50, a 33-inch steel roll with a segregation excess of 0·52% of carbon.

§ 267. SPECIAL FEATURES OF SEGREGATION.—By applying severe pressure to partly solidified cast-iron, Stead caused the molten interior, into which much phosphorus had already segregated, to burst the still tender walls and gush out.[b] The ejected matter contained 6·84% of phosphorus, while the cast-iron treated held b ıt 1·53% (No. 105, Table 94). Now in a like way the pressure which the rapidly cooling and contracting walls exert on the interior during the early part of the solidification may squeeze drops of the still molten metal through the walls, as mercury is squeezed through chamois. Riley's pea-like drops, containing over 4% of phosphorus, occurring on phosphoric cast-iron,[c] are doubtless instances of this action; others are given in Numbers 115 to 118 of Table 96.

The excess of contraction of the interior over that of the exterior after the period when the shell has become rigid, causes internal cavities: and in and around these cavities we may expect to find the last-freezing part of the metal, and the segregation if any there be. Occasionally it shoots out in little pine-tree crystals into these vugs.

But we may find in the vugs not the last- but the first-freezing part of the metal. Thus, if in a narrow casting, such as a pig of spiegeleisen, early forming crystals shoot completely across the mass, these crystals may be found stretching across the vug which forms by contraction later. Of this we seem to have an example in Numbers 106-108 of Table 96, for the composition of the vug-crystals indicates that they are less fusible than the mother-metal.

(TO BE CONTINUED.)

NOTE.—The publishers of the ENGINEERING AND MINING JOURNAL will thank the readers of this article if they will promptly call attention to any inaccuracies they may observe in it.

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[a] By the "segregation-excess" of a given element, I mean the excess of the percentage of that element in the segregation over that in the mother-metal. So with "segregation-deficit."

[b] In 1883 I proposed concentrating the phosphorus of phosphoric cast-iron by casting the metal in large blocks as it ran from the blast-furnace, and bleeding them when partly solidified, thus obtaining relatively pure shells.

[c] E. Riley, Journ. Iron and St. Inst., 1881, II., p. 393.

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ute. Cooled very slowly in moulding sand, so that though cast on Saturday it was not cold on Monday. Ingot 7′ × 19″ × 19″. Mother-metal = average composition at outside. Segregation = centre of a slice cut 21″ from the top. (Manganese from slices near bottom and near top.)

48. Idem. Open-hearth steel ingot 3′ 6″ × 21″ × 17″. Mother-metal = slice 4″ from bottom: segregation = slice 10″ from top.

49. Idem. Bessemer rail ingot, 4′ × 13″ × 13″ at bottom. Mother-metal = slice 3½″ from bottom, segregation = slice 12″ from top.

50. A broken steel roll, 33″ in diameter. Mother-metal = chippings from exterior, segregation = chippings from centre. Source withheld.

51 to **54.** H. Eccles, Journ. Iron and St. Inst., 1888, I., p. 70. Steel plates. Mother-metal = planings from outside of plate: segregation = cuttings from inside of plate.

55. Forged steel shaft, about 19 in diameter. Mother-metal = large end of shaft, segregation = small end. Source withheld.

56 to **58.** Bessemer steel tyres, Ledebur, Stahl und Eisen, VI., p. 147, 1886. Borings, obtained with a slowly moving dull drill, were sifted through a very fine sieve. For comparison with the other results here collected, the coarser borings, representing the tougher material, are here classed as mother-metal, the finer and more brittle ones as segregation, though they hardly come within the legitimate use of these words.

59. An ingot weighing several tons was drilled at top and bottom. Mother-metal = bottom. Segregation = top. W. Metcalf, Trans. Am Soc. Civ. Eng., XV., p. 236, 1887.

60. A large bar of steel made for rolls by Krupp. Mother-metal = outer turnings: segregation = inner borings. Idem.

61. A sound ingot. Mother-metal = approximate average composition of outside, segregation = spot near the top containing the maximum of carbon. Maitland, The Treatment of Gun-Steel, Excerpt. Proc. Inst Civ. Eng., LXXXIX., p. 12, 1887.

62. Fourteen layers, each 1-16th inch thick, were planed from one of the Lividia's boiler-plates. Mother-metal is the average of the two outer layers: segregation is the layer richest in carbon, phosphorus and sulphur. The manganese varied only between the limits 0·237 to 0·410%. W. Parker, Trans. Inst Nav. Arch., XXII., p. 20, 1881.

101. Crust and inner part of Gruson chilled cast iron armor. Ledebur, Stahl und Eisen, IV., p. 635, 1884.

102. Ditto, ditto, for a chilled cast-iron tread-wheel. Idem.

103. Very slowly cooled dark-gray Bilbao cast iron. Idem.

104. Mother metal, dark gray, coarse-grained pig-iron: segregation, light gray, fine-grained, kidney-shaped mass contained in a vug, and in some cases wholly detached from the walls. Idem.

105. About 100 lbs. of Cleveland cast-iron was cast in a mould, and when it had become pasty, was subjected to severe pressure: the still molten internal part gushed out: it is here given as segregation. Mother-metal = the composition of the cast-iron used. A second experiment gave like results. J. E. Stead, Dingler's Polytech Journ. CCXXX., p. 276, 1878. From Iron, X., pp. 553, 586, 651, 1877.

106 to **108.** Mother-metal = a fine-grained spiegeleisen, yielding when attacked by acids a brown residue of carbon, silica and iron. Segregation = smooth, mirror-like, parallel or acutely crossing, leafy crystals stretching across the vugs: perhaps 0·004″ (0·1. mm.) thick in their middle, thicker where attached to the walls of the vugs: quickly acquiring in the air a thin, deep-blue, oxide tint: leaving a residue of pure silica when attacked by acids. B. Platz, Stahl und Eisen, VI., p. 244, 1886.

109. Five or six tons of white cast-iron were very slowly cooled in a previously warmed mould, covered with sand. Mother-metal, upper figures = composition of original cast-iron: lower figures = average of composition at four points at the outside of the cooled block. Segregation = a point near the center. Bell, Journ. Iron and St. Inst., 1871, II., p. 295.

115. Mother-metal, gray easily worked iron: liquation, brittle drops and thin sheets on the outside of the metal, pulverizable in a mortar. Ledebur, Stahl und Eisen, IV., p. 637, 1884.

116. In Siegen cast-iron (mother-metal) were found pea-sized globular liquations. G. Lentz, Stahl und Eisen, VI., p. 443, 1886.

117. Specks floating on the surface of molten cast-iron, and the cast-iron itself. Ledebur, Handbuch der Eisenhüttenkunde, p. 257.

118. Molten cast-iron, and matter separated from its surface by Schneider's separator. Ledebur, Stahl und Eisen, VII., p. 171, 1887.

PERSONAL.

Mr. E. Gaujot, Mining Engineer of Belleville, Ontario, has gone South on professional business.

Mr. T. W. Page Breckom, well known in mining circles, has gone to San Francisco on professional business.

Mr. Fred Bishop has resigned his position as Superintendent of the plant of the Warren Iron and Steel Company, at Warren, Ohio.

Col. W. J. Sutherland, of London, General Manager of the Candelaria Water-Works and Milling Company of Nevada, has gone West on business connected with his various mining interests.

Mr. Edwin Mickley, superintendent of the mining interests of the Thomas Iron Company, of Hokendauqua, Pa., for the past 32 years, has resigned his position, to take effect on March 1st, next.

Dr. William Weightman, superintendent of the extensive chemical works of his father, William Weightman, at the Falls of Schuylkill, Pa., died at his home in Philadelphia, this week, aged forty years.

Advices have been received at Panama stating that D. C. Kline and Louis Janin, Jr., arrived at that point on the 29th ult., and started for the Santiago mine in the Republic of Colombia on the 30th ult. They should have reached the mine on the 6th inst.

Mr. Job L. F. Lightner, a well-known mining official in San Francisco, Cal., died there on the 7th inst. aged sixty-three years. He came from New York, was a pioneer, and for twenty-eight years served as secretary of the Hale and Norcross Mining Company of Nevada.

Mr. James Douglas, Jr., President, and Mr. Joseph Van Vleck, Secretary and Treasurer of the Copper Queen Consolidated Mining Company have gone to the company's mines at Bisbee, Arizona. Mr. Douglas left New York on the 4th inst. and Mr. Van Vleck followed ten days later.

Mr. R. S. Oberholser, of Pittsburg, and Mr. G. Hughes, of Cleveland, have been engaged by the Laughlin and Junction Steel Company, of Mingo Junction, O. Both gentlemen secured their appointments through the ENGINEERING AND MINING JOURNAL, which publishes every week a list of positions vacant.

Mr. John Williams, mining engineer, has gone to Mexico on professional business. He will be absent three weeks. Parties wishing to consult Mr. Williams can address him at Tlalpujahua, Estado de Michoacan, Mexico, until 23rd inst., after that he will go to the Iturbide Hotel, City of Mexico, where he will be for several days.

Mr. E. S. Philbrick, civil engineer, died suddenly on the 13th inst. on a train bound for Brookline, Mass. Mr. Philbrick was sixty-five years of age, and was civil engineer of the Boston & Albany Railroad, and since his retirement from that position he has acted as consulting engineer of the road in the construction of bridges on the Boston & Worcester division.

Mr. S. Lowell Elliott died in Brooklyn, N. Y., on the 13th inst., aged forty-five years. Mr. Elliott throughout his life had been particularly diligent in scientific research. He was a member of the New York Academy of Science, the American Association for the Advancement of Science, the American Geographical Society, and other associations.

Engineers, chemists, metallurgists and others desiring engagements are advised to inspect the column of positions vacant published on another page. This week we notice, among others, the following wants: A mining engineer to go to South America at once; an assistant superintendent for chemical works near New York; a reduction-mill manager; a manager for a large rolling-mill; a competent hydraulic mining engineer to take charge of a South American placer property; a chemist for metallurgical laboratory work; an assistant mine captain, and a mining superintendent.

The fifty-third meeting of the American Institute of Mining Engineers will be held in New York City, beginning Tuesday evening, February 10th. The programme is as follows;

Tuesday evening, opening session; Wednesday morning and afternoon, general excursion to the Spiral Weld Tube Works and the Edison Laboratory at East Orange, N. J., with a session at the Edison Laboratory, devoted to the applications of electricity in mining. A paper is promised from Mr. Edison. Evening—Session devoted to papers and discussions connected with iron and steel. Thursday, morning and afternoon, sessions, at which, if the council so decides, the subjects of the Wednesday evening session may be continued. At the afternoon session, the election of officers and other business will be transacted; evening, subscription dinner at the Hotel Brunswick. Friday, morning, session at the Stevens Institute, Hoboken, followed by a social reception at the house of President Morton; afternoon, numerous local excursions, in parties, according to the preferences of individual members; evening, social reception; Saturday, morning and afternoon, local excursions.

Detailed programmes of the local committee, containing particulars of excursions, etc., will be furnished to members on arrival at the Headquarters Bureau of Information. The following papers have been announced thus far:

A Rapid Method for the Determination of Phosphorus in Volumetric Analysis, Clemens Jones, Hokendauqua, Pa.

A Hollow Iron Pig-Pattern, by B. F. Fackenthal, Jr., Riegelsville, Pa.

Notes on the Electrolytic Assay of Copper, by William Glenn, Baltimore, Md.

Coal Transfer of the Mt. Carbon Company (Limited), by W. N. Page, Mt. Carbon, West Va.

Gold-Milling in the Black Hills, by H. O. Hofman, Rapid City, Dakota.

The Economy of Modern Air-Compressors. Compared with the Calladin Type, by J. E. Denton, Hoboken, N. J.

Note on the Koepe system of Winding from Shafts, by J. H. Harden, Phœnixville, Pa.

Ore Deposits of the Black Hills, by F. R. Carpenter, Rapid City, Dakota.

The Copper Deposits of Copper Basin, Arizona, and Their Origin, by W. P. Blake, New Haven, Conn.

The Determination of Silicon in Ferro-Silicon and a Study of Its Reactions with Alkaline Carbonates, by Henry J. Williams, Pittsburg, Pa.

A Study in Isochemic Lines, by David H. Browne, Ann Arbor, Mich.

The Venström Magnetic Separator, by Robert A. Cook, New Brunswick, N. J.

End Lines and Side-Lines in the Mining Law, by R. W. Raymond, New York City.

The Influence of Silicon in Cast-Iron, by W. J. Keep, Detroit, Mich.

A New System for Operating Regenerative Hot-Blast Stoves, by Jacob Wainwright, Pittsburg, Pa.

Also papers by Mr. Arnold Hague concerning the geysers of the Yellowstone National Park, and by Mr. Thomas A. Edison, on certain applications of electricity in mining, the exact titles of which have not been received.

Several other papers, of which the secretary has been more or less positively informed, or concerning which he is still in correspondence with the authors, are omitted from the foregoing list, by reason of uncertainty as to their presentation.

INDUSTRIAL NOTES.

Work has been commenced on the erection of the new plant of the Union Steel and Iron Company, at St. Joseph, Mo., and it is expected to be ready for operations by May next.

The Brooke Iron Company, at Birdsboro, Pa., on the 9th inst., gave notice of a reduction in puddlers' wages of 25 cents per ton, from $3.25 to $3. The mills at Pottstown and other places recently made similar reductions.

The Henderson Steel Manufacturing Company at Birmingham, Ala., went out of blast on the 9th inst., in order, it is given out, to enlarge the plant, which has been making a daily output of about 6 tons of good quality steel.

The Eureka Company, of Oxmoor, Ala., will, it is reported, begin within the next month the erection of two 125-ton furnaces. The De Bardeleben Coal and Iron Company, at Bessemer, Ala., will begin to build a new furnace next month.

The Bethlehem Iron Company of Bethlehem, Pa., will hold a special meeting on the 19th inst., for the purpose of voting for or against an increase of the capital stock from $2,000,000 to $3,000,000, or to such amount not exceeding $3,000,000 as may be approved at said meeting.

Report reaches us from Wichita, Kans., that on one of the Thomson Houston motors in use on the electric railway a copper brush was in continuous use for 65 days, during which time the car covered a distance of 4,300 miles. This is probably the longest time that a motor brush has been in continuous use, and speaks the highest praises for this make.

It is reported that the Sheriff of Montgomery County, Pa., has levied on the personal property of Professor T. S. C. Lowe on an execution for $1295. Professor Lowe is at the head of the Lowe Manufacturing Company, whose business is the manufacture of water gas, and whose machine-supplies works were recently removed from Norristown to the Pacific slope.

A company has been incorporated by Charles Kellogg, W. Hauxhurst, W. S. McCord, Robert Grimes, and John C Wells for the purpose of building bridge works at Elmira, N. Y. The company will have an office in New York, which will be the headquarters for Mr. Hauxhurst. Mr. Kellogg was for years at the head of the great bridge works of Athens, Pa.

The chemical laboratory of the Ohio State University at Columbus was totally destroyed by fire early on the morning of the 12th inst. The loss is estimated at $50,000. The firemen had great trouble in saving the main building. The origin of the fire is unknown. The laboratory contained the outfit for the Department of Mining Engineering and Metallurgy.

The charcoal furnace of the Ashland Iron and Steel Company, at Ashland, Wis., is now in good running order, and, it is stated, is exceeding the production of any other charcoal furnace in the world. The size of the stack is sixty-five feet by twelve feet and a half, and it is equipped with two Whitwell hot-blast stoves. Its output for the week ending February 2d was 642 tons.

Messrs. Morris P. Canfield and Robert A. McKean, of Pittsburg, having secured the title and good-will of the Pittsburg Construction Company, have associated themselves together under the name of the Pittsburg Construction Company, for the purpose of carrying on the constructing and engineering business in all its branches. They have also been granted license by M. V. Smith to construct the Smith regenerative gas furnace and producers.

The Carp furnace at Marquette, Mich., is to be started again by a company of Marquette captialists. The buildings are in good repair, but the stacks will need repairing, and much of the machinery is antiquated and must be replaced. Instead of using charcoal for fuel, coke will be used exclusively. As this experiment of making pig-iron near the mines, with coke for fuel, will be the first to be tried in the Lake Superior iron region, its success or failure will determine the future of the new industry in this district.

The Westinghouse Company has secured control of the United States Electric Light Company for a period of forty years. This important acquisition, together with the purchase of the plants of the Tesla Motor Company and the Waterhouse Electric Light Company, and the lease of the Sawyer & Man factory, make the Westinghouse combination one of the largest in existence. The entire business of the combination will be under the general supervision of Mr. George Westinghouse, Jr., the principal owner.

In the United States Circuit Court at Pittsburg, Pa., on the 9th inst., the Consolidated Electric Light Company made a motion for a hearing in the suit against the McKeesport (Edison) Light Company, upon the Sawyer-Man fibrous carbon patent, the testimony of which has been closed in the United States Circuit Court. This motion was opposed by the New York counsel of the Edison Company, who asked the court for leave to file a motion to re-open the case to take further testimony in defense. The court continued the motion of the Consolidated Company until next Saturday and permitted the Edison Company to serve its motion for delay, to be heard at the same time as the complainant's motion for an early hearing.

THE DUTY ON STEEL CROP ENDS.—Assistant Secretary Maynard has informed a firm of New York importers that the question recently decided in the Supreme Court in the case of Robertson against Perkins was simply to the effect that as steel was a metal specified in the tariff acts, steel rail crop ends cannot be classified under the provision for "metal unwrought not specially enumerated or provided for." The question as to whether such ends or pieces of steel rails are dutiable as "steel not specially enumerated or provided for," or as "scrap steel," was not, he says, presented in that case, but was covered by a previous decision of the court in the Schlesinger case. This decision, he says, is the basis of Department's ruling of February 14th, 1887, that such merchandise having been in actual use in making the rails, is dutiable under the provisions for "scrap steel," The Department therefore declines to apply the decision in the Perkins case to certain steel rail crop ends heretofore imported.

CONTRACTING NOTES.

Our list of machinery and supplies wanted will be found on page xviii. Manufacturers of machinery, engineers and contractors should also consult our directory of "Contracts Open" on page xviii. This week, proposals are invited for the following new contracts: No. 1293, Furnishing Mineral Oil; No. 1294, Railway Construction; No. 1295, Building Stone Arch Bridge; No. 1296, Construction of Water-Works System; No. 1297, Building Sea Wall; No. 1298, Erecting Machine, Boiler and Smith Shops for Pennsylvania R.R. Company, at Altoona, Pa.; No. 1299, Furnishing Coal.

The Midvale Steel Company, of Philadelphia, Pa., has been awarded the contract for furnishing all the tires to be used on the New York Central & Hudson River Railroad and the West Shore Railroad during the year 1889.

The Columbian Iron Works and Baltimore Dry Dock Company have been awarded the contract for building a new steel tank steamer for the Standard Oil Company, of New York. The contract was awarded in competition with iron shipbuilders throughout the North. The vessel will be an awning-decked screw steamer, 240 feet long, 36 feet beam and 23½ feet depth of hold, and her draft at the load line will be fourteen feet. She will be built according to Lloyd's requirements, and is to rate A1. All the material is to be of open-hearth steel, 13-20ths of an inch thick.

GENERAL MINING NEWS.

A new corporation has been formed under the laws of New York combining the granite interests of the firm of Booth Brothers and the Hurricane Granite Company, with a capital stock of $250,000. The company will operate the quarry at Millstone Point, Conn., and the following quarries in Maine: Long Cove, St. George, Atlantic Quarry, Seal Harbor, the Hurricane Isle quarry and two at Vinal Haven. The officers are: William Booth, of New London, President, and John Ronelson, of New York, Secretary. The company's headquarters will be in New York.

STANDARD OIL COMPANY.—It is authoritatively announced that the land recently purchased by the Standard Oil Company in New Haven and Waterbury will not be utilized for the location of oil refineries, as was at first supposed. No crude oil will be brought into Connecticut for refining purposes. The land will be used simply for the erection of distributing stations in order that the customers may be sup-

plied with oil without the necessity of it passing through jobbers' hands.

ARIZONA.

COCHISE COUNTY.

COPPER QUEEN CONSOLIDATED MINING COMPANY.—The stockholders of this company held their annual meeting at the New York office, No. 54 William street, on Tuesday last. The following trustees were elected: William E. Dodge, D. Willis James, James Douglas, Joseph Van Vleck, Horace K. Thurber, Edward Smith, Clarence F. Birdseye. Mr. Douglas continues to serve as President, and Mr. Van Vleck as Secretary and Treasurer. Mr. Wm. E. Dodge was chosen Vice-President.

PIMA COUNTY.

PEERLESS MINING COMPANY.—The surface stopes near the Peer line continue to furnish milling ore. Stoping on the surface has been commenced both ways from the new shaft to connect with 200 level, and the vein continues strong in the bottom and the ore broken is of good grade. The stopes on the 200 and 300 foot-levels continue to furnish ore of good quality. In west cross-cut No. 2 on the 300-foot level 150 feet south of the main upraise, a winze has been sunk 20 feet, with the bottom in ore of good grade. Bullion valued at $12,070.06 has been shipped, and there is bullion on hand valued at about $800.

CALIFORNIA.

AMADOR COUNTY.

AMADOR GOLD MINE.—Mr. H. R. Lounsbery informs us that the work of developing this property proceeds steadily and satisfactorily. Shaft No. 4, the principal shaft, has now reached a depth of 433 feet.

SANTA CLARA COUNTY.

QUICKSILVER MINING COMPANY.—At the regular monthly meeting of the board of directors of this company, this week, the following financial statement was presented:

Deposited in Mechanics' Bank	$40,237.66
Deposited in Bank of California	71,800.00
Quicksilver on hand	144,706.50
Total assets	$256,744.16

The unpaid pay-rolls amount to $3,300. The January production was 1200 flasks; sales for the same period amounted to 2432 flasks. As predicted in the ENGINEERING AND MINING JOURNAL a month ago, a dividend of one dollar and a half per share was declared.

COLORADO.

The Denver *Republican* publishes the following additional statistics regarding the coal and coke industry of Colorado, which were furnished by Mr. John McNeil, State Inspector of Coal Mines:

During the year 1888, according to the returns received from the various mines, 2,185,477 tons of coal were produced. Out of the above stated product 700,574 tons were shipped outside of the State, mainly to points in Kansas, Texas, and Nebraska.

The average value of coal on the cars was at the mines $2.20 per ton, making the value of the State production in 1888 $4,808,049.40. The average number of persons employed is 5375. The average thickness of the coal seams now being worked is 5 feet 5 inches. The thickest is 14 feet and the thinnest is 1 foot and 8 inches. There have been 170,434 tons of coke made during the year, produced by companies as follows:

	Tons.
Colorado Coal and Iron Company, El Moro mines	95,100
Colorado Coal and Iron Company, Crested Butte mines	40,700
Trinidad Coal and Coke Company	19,634
Grand River Coal and Coke Company	15,000
Total	170,434

BOULDER COUNTY.

CARIBOU MINING COMPANY.—Mr. M. A. Smith, of New York, has leased and bonded the old Caribou mine at Caribou. Mr. Smith is backed by a St. Louis syndicate of capitalists. The mine, which has been a great producer, will now be actively worked.

CLEAR CREEK COUNTY.

MARY FOSTER MINING COMPANY.—The difficulties of this company have been adjusted. Captain D. I. Ezekiel, of Denver, has been appointed superintendent and Henry Mears foreman. The property of this company is situated on Cascade and Ute creeks.

TWO SISTERS MINING COMPANY.—This company has leased and bonded the Murray mine on Columbian Mountain, and has commenced work by putting the several workings in a condition for a systematic exploration.

EAGLE COUNTY.

[From our Special Correspondent at Gilman.]

From present indications the entire east front of Battle Mountain will be alive with pick and shovel during the summer. Not only to Battle Mountain does this marked epoch of general activity extend, but also to the entire outlying districts in Eagle County. From all sections come news of renewed enterprise. Few idle properties are to be heard of; the owners and lessees of claims seem to have become aware of the fact that no better field for successful mining operations than here exists in Colorado. It is not exaggeration to state that the mineral belt in this district has been little more than scratched, for as the numerous paying properties of the camp achieve farther depth novel and astonishing features constantly occur to testify to the permanency and value of the ore-deposits. New investors have appeared and many claims quietly changed hands during the past few months.

BEN BUTLER.—This mine is drained of water, and active labor commenced. Mr. Grossmayer, *et al.*, of Denver, are leasing this property, which made such a phenomenal yield in 1887-88, and sold for $70,000.

BLEAK HOUSE.—The lessees are extracting ore rapidly from the vein and making money.

CLINTON, SPIRIT AND CLEOPATRA.—These are working upon their sulphide bodies and shipping steadily. The average of the ore is $100 to $400 per ton. The McDonald lease on the Iron Mask has encountered a body of ore to the left of the main incline twelve feet thick. The ore carries gold in paying quantity.

CHAMPION MINE.—The shipments continue undiminished, the litigation with the C. & C. shaft still pending.

EUREKA.—This mine, from which the lessees made thousands in a few months, is being operated at present by one of the owners, Mr. Graham.

GREAT HOPES.—Mr. Fulford's great strike here has proven all that has been claimed for this mine. Your correspondent visited this vein in Eagle Cañon two days ago, and found a vein of white quartz standing in granite 16 feet wide, though as yet in the broken formation. Mr Fulford drifted 8 or 10 feet to the right, encountering the hanging wall. He then drove ahead upon the conglomerate mass 25 feet, sunk a winze some 20 feet, and from appearances has attained the true hanging wall below, with about 8 inches of silver ore running in silver into the thousands to the ton. One assay showed 99 ounces gold, 2100 silver. If the streak continues as large as at present Mr. Fulford has a bonanza.

GROUND HOG GROUP.—All of the lessees are doing well. New ore-bodies are being uncovered constantly, proving the property to be a very valuable one and not as yet half developed.

HENRIETTA AND EIGHTY-FOUR.—These are two important strikes in the lime contact. They are located on the southern slope of Battle Mountain, a hitherto neglected part. The ore is very high grade. The C. & C. shaft to cut the quartzite strata, it is reported from good sources, has reached the contact in ore. After the conclusion of the other great apex case, Durant vs. Bonnybell of Aspen, the Champion vs. Battle Mountain will be in order. Some of the best experts and attorneys in the West will be engaged. All of the famous quartzite mines have resumed operations.

IRON MASK.—The head house was burned to the ground two weeks since. No insurance. Total loss, including machinery, $4000. A new and more commodious building, with pumps and all necessary works, has been erected, and the heavy shipments of sulphides resumed.

LAST CHANCE.—The lessees have encountered rich sulphides. A strike of importance is expected here.

OLD BELDEN.—Mr. J. C. Swinbourne, of Leadville, has been here completing arrangements for the resumption of work upon this mine, one of the first producers in the camp.

PERCY CHESTER AND GOLDEN WONDER.—These were heavy producers in 1888, and are about to be started. Work will be resumed immediately upon large ore faces in the breast, and shipments commenced from the start.

POLAR-ACCIDENTAL.—Shipments continue as regularly as ever, new strikes being continually reported.

GILPIN COUNTY.

CASHIER MINING COMPANY.—Rumors that this company is to be reorganized have been current in New York for some time past. This week, Mr. A. G. Bradstreet, of Bradstreet & Curtis, one of the largest stockholders in the company, said to a representative of the ENGINEERING AND MINING JOURNAL: "I am now at liberty to state that this company will shortly be reorganized, and that an assessment of not over seven cents a share will be levied. Not a cent is owed and the interest on the bonds has always been paid, because the bondholders are also the largest stockholders. We are now in need of money for the further development and exploration of the property. Heretofore we have never been able to treat the ore profitably. It has run pretty regularly about $20 a ton; but as it is unusually refractory, it has cost us as much as that to extract the gold. Lately, we have struck as high as $60 ore, and we are anxious to continue our explorations. To secure the necessary money we have determined upon a reorganization. Our superintendent estimates that about $15,000 will be required, while the reorganization will bring into the enterprise at least $41,000. We do not anticipate any opposition to this move, as it is for the good of all concerned. In a few days we shall issue a circular telling how the company stands and what we propose to do. In the meantime, Mr. Thos. Edison is experimenting on our ore with his electric extraction process, and he is very sanguine that he can greatly decrease the cost of extraction."

LAKE COUNTY.

CATALPA MINING COMPANY.—Out of the 300,000 shares comprising the capital stock of this company, about 75,000 were represented at the annual meeting of the stockholders held at the New York office on the 13th inst. The board of trustees stands as follows: J. P. Whitney, B. C. Paddock, P. H. Bartling, Peter Butler and J. C. Watson. Mr. Whitney was elected President and Mr. W. J. Downing Secretary and Treasurer. Mr. Chas. L. Hill will continue to act as the company's superintendent at Leadville.

CRESCENT MINING COMPANY.—The annual meeting of this company's shareholders was held at the same place and hour, and the same trustees and the same officers serve for both companies. Fifty thousand shares were represented.

PITKIN COUNTY.

The Durant-Bonnybel mining litigations, the official title of which is "D. M. Hyman vs. D. R. C. Brown, Y. C. Bacter, *et al.*," which was called before Judge Hallett, in the United States Circuit Court, at Denver on the 28th ult., and to which we referred in our issue of the 2d inst., the verdict was rendered on the 12th inst. in favor of the Bonnybel mine.

SUMMIT COUNTY.

VICTORIA MINING COMPANY.—We understand that this company's mill started up last Monday, and is working satisfactorily. Our informant further states, and we give it simply as his statement, that a three-inch vein of ore has been struck, assaying very high, and that a much wider vein, running $10 per ton, has also been encountered.

DAKOTA.

LAWRENCE COUNTY.

CALEDONIA MINING COMPANY.—Superintendent T. H. Skinner writes to parties in New York under date of the 4th inst. that during the week ending on that day, the output of the mine amounted to 1648 tons of ore, all of which was delivered to the mill. Mr. Skinner also says: "We are opening out a new stope on the 300-foot level where the connection was made with the winze from the 200-foot."

DEADWOOD-TERRA MINING COMPANY.—The product of this mine for January was $59,852.17. The New York representatives of the company advise us that the cash balance on the 1st of January was $99,737. As in the list of financial statements published in the ENGINEERING AND MINING JOURNAL of January 26th the Deadwood-Terra Mining Company was represented as having an indebtedness of $10,000, they wish to explain that their sworn report to the County Clerk (from which the JOURNAL took the figures published) stated that their indebtedness *did not exceed* $10,000, but did not mention the credit balance in the company's treasury. We are glad to obtain this explanation, as it will allay the fears of a number of stockholders who were surprised at the company's indebtedness.

HOMESTAKE MINING COMPANY.—We are officially informed that the product for January amounted to $89,346.85. The financial agents of the company in New York state that they have not heard any unfavorable reports concerning the work of the big steam stamp.

ILLINOIS.

The Pittsburg railroad coal operators on the 11th inst. received from the Ohio Coal Exchange a report of a committee sent to Illinois to inquire into the coal interests of that State. The report shows that the output for 1888 was 12,000,000 tons, or 1,600,000 more than 1887. That the operators declare they will, under no consideration, recognize or co-operate with organized labor, and, further, they absolutely refuse to co-operate with operators of Pennsylvania and Ohio in any inter-state movement.

INDIANA.

A party of New York capitalists were in Muncie, this week, to perfect, it is stated, the organization of a company with $2,000,000 capital to develop the natural gas resources of that region. This company has purchased 2000 acres of land in and adjoining the city. Ex-Governor Leon Abbett, of New Jersey, has been chosen president of the company, and associated with him are the following New York gentlemen: Messrs. E. G. Ridout, J. M. Woods, S. C. Thompson, John T. Phillips, W. S. Osborn and Dr. Walter Fleming.

MICHIGAN.

COPPER MINES.

Another decision has been given against the Quincy Mining Company in their attempt to secure a right of way for their railroad through the Franklin and Pewabic properties.

To the following table, which was published in our last issue, some figures have been added. The table shows the production of the Lake Superior copper mines for January, and the corresponding period in 1888 and 1887:

	1889. Tons.	1888. Tons.	1887. Tons.
Calumet & Hecla	2,600	1,888	2,694
Tamarack	620	631	300
Quincy	240	351	183
Atlantic	223	229	202
Osceola	207	210	158
Franklin	180	178	201
Huron	131	110	104
Allouez	112	....	....
Kearsarge	95	....	....
Central	81	89	120
Copper Falls	68	....	84
Total eleven mines	4,557	3,686	878

CALUMET & HECLA MINING COMPANY.—It is reported that there is still fire in the mine, but company officials say that this means "That there will probably be delay in getting into the fire district and opening that part fully. Unless all is right for that course they will wall it in from the rest of the mine as in former years."

IRON MINES.

CHAPIN.—It is reported that this mine, on the Menominee range, has been leased for 30 years for a cash consideration, and subject to a royalty of 40 cents a ton.

PITTSBURG & LAKE SUPERIOR COMPANY.—General Alger has bought Pittsburg & Lake Superior Company's iron mine for $800,000, including 1800 acres of iron land. The mine has been a continuous producer since 1871, shipping 56,321 tons of ore last year.

NEVADA.

HUMBOLDT COUNTY.

ADELAIDE COPPER COMPANY.—Official information shows that when the company got its furnace finished late last spring it experienced some difficulty finding a suitable iron ore for flux, as its ore is very silicious. This was overcome, and our furnace was started, only to find after a few hours' run that, owing to an unusu-

ally dry season, the water supply was inadequate, and the company was compelled to close down. It could either move the works to the Humboldt River, twelve miles distant at the station, or wait till the snow or rain raised the creek. The company decided to wait. The consequence is, with the exception of a few tons of bullion run out on the start, it has smelted nothing The bullion was 96 fine and 52 ounces silver per ton. A few months ago a powerful hoisting engine was erected, and the main shaft sunk deeper for the purpose of opening up another level. It is below water level, and considerable high grade sulphuret ores running 25 per cent copper, $15 gold, and 25 ounces silver are being taken out. The majority of the ore in the shaft runs from 8 to 15 per cent copper and $16 in gold and silver. The water is rising in the creek, the weather favorable, and it is expected to start the furnace, a 80-ton water jacket, in a couple of weeks. The company has cross-cut the ledge 60 feet in width, and drifted on it 115 feet, all in good pay ore. Work will be pushed vigorously this year to make up for last year's delay.

STOREY COUNTY—COMSTOCK LODE.

We condense the following from the Virginia City *Chronicle:*

The daily yield of the Comstock mines is now 800 tons, divided as follows: Con. Cal. & Va., 360; Savage, 80; Hale & Norcross, 130; Chollar, 120; Confidence and Challenge, 100; Alta, 30; Justice, 40. If there were sufficient water to operate the river stamp mills to their full capacity, the daily average ore yield of the lode would be above 1200 tons. The monthly bullion yield of the lode with the present ore crushing facilities is above $500,000 monthly. Last year at this time it was above $750,000.

BENTON CONSOLIDATED MINING COMPANY.—Superintendent Loughran, of the Benton, has reported favorably to the Benton Company after an inspection of the steam hoist plant at the Ward shaft, but so far as known negotiations for its purchase have not been concluded. The plant is one of the finest on the lode It is almost new, in first-class order, with a sinking capacity of 3000 feet.

HALE & NORCROSS MINING COMPANY.—The company reports having shipped since last report 1698 tons of ore, battery sample assays showing an average value of $21 per ton. This includes the ore shipments for two weeks ending February 5th. Bullion valued at $58,350 has been shipped on January account.

OHIO.

OHIO & WESTERN COAL AND IRON COMPANY.—This company filed an assignment in Columbus on the 11th inst. to James A. Hall, without preference. The New York office is at 11 Pine street, the principal office is at Columbus, Ohio, and there is also a branch office at 8 Congress street, Boston. The mines and furnaces are at Floodwood, Shawnee, Peru, Orbiston, and Monday. The deed of assignment conveys to the Assignee all the lands, furnaces, buildings, and appurtenances of the company, subject to a mortgage to the Boston Safe Deposit and Trust Company. The deed is signed by Chester Griswold, Vice-President, and George C. Thomas, Secretary. The President, John M. Glidden, was of the firm of Glidden & Curtis, of Boston, who failed last week, and their failure precipitated the assignment of the company. According to the company's annual report on January 16th, the the liabilities were $3,309,000, of which the bonded debt was $2,399,000, and other debts with collateral security $910,000. The assets consist of 7000 acres of coal land in the Hocking Valley, Ohio, valued at $400 to $500 per acre, about 300 houses, 3 large stores, 400 railroad cars, 4 miles of track, 3 coal mines fully equipped, 4 furnaces, and a large amount of miscellaneous equipments. The directors of the company are: John M. Glidden, George R. Chapman, Joseph W. Smith, F. K. Pendleton, Chester Griswold, S. L. Parrish, O. D. Lombard, C. S. Foote, James A. Hall and Thomas Cochran. Mr. F. K. Pendleton, of New York, the attorney representing the Eastern interests of the company, is at Columbus endeavoring to straighten out the affairs of the company. He states that that the attachments made by the Hocking Valley Railroad Company to satisfy their claim of about $21,000 for freight will probably be set aside by the courts. The local indebtedness of the concern in this State will not probably exceed $40,000. As soon as the entanglements of the company have been straightened out it will be reorganized upon a solid financial basis and all of the furnaces started up. The collapse is most unfortunate at this time, as the furnaces are all new, although built some years ago. They went into blast about the first of last November, and have been turning out an excellent quality of iron since going into operation.

According to *Bradstreet's* reports the company is a reorganization of the Standard Coal and Iron Company, which was sold out under foreclosure in 1883, and was bid in by D. N. Stanton, Thomas T. Mason and George Chapman, who held it as trustees pending the organization of the present company. This company was incorporated under New York State laws October 25th, 1883, with a capital stock of $5,000,000 and bonded debt of $3,500,000.

PENNSYLVANIA.

COAL.

GRAND LAKE COAL COMPANY.—This company, which is one of the largest coal firms in Pittsburg, has confessed judgments for $40,000, in favor of Isaac S. Van Voorhis in trust for certain creditors. The sheriff made a levy on the 15th inst. on three of their tow-boats. The extent of the failure is not known. The embarrassment, it is said, dates back to last August, when the great storm at New Orleans destroyed a large amount of the coal and craft. The members of the firm are John and James Williams and Thomas Patterson. The company was a member of the Pittsburg and Southern Coal Combination.

STERLING COAL COMPANY.—A charter has been granted at Harrisburg to this company, which has purchased the Powell property, in the Clearfield region, and 10,000 acres more of coal lands in the same neighborhood. Efforts have been made by the company within the last few weeks to secure control of other coal lands in the Clearfield Basin; in two cases, however, the owners refused to sell their land. Another field of operation will be in Cambria County, where coking coals are found. This coke, it is stated, will come into competition with Connellsville coke.

OIL.

Exports of refined, crude, and naphtha from the following ports, from January 1st to February 9th:

	1889. Gals.	1888. Gals.
From Boston	543,458	182,992
Philadelphia	12,619,108	8,524,697
Baltimore	2,013	599,309
Perth Amboy	1,262,736	1,879,366
New York	41,814,512	34,202,503
Total exports	56,241,827	45,388,867

TENNESSEE.

The total output of coal in Tennessee in 1888 was 1,967,297 tons, against 1,714,290 tons in 1886.

SHELBY COUNTY.

According to reports, natural gas has been discovered at Kerville, on the Chesapeake & Ohio Railroad, 20 miles northeast of Memphis, at a depth of 50 feet. The well was accidentally discovered by workmen digging for water.

UTAH.

SUMMIT COUNTY.

ONTARIO SILVER MINING COMPANY.—On the 6th inst. a ventilating shaft for the Ontario's big three-mile drain tunnel was started. It is being sunk, says the *Park City Record*, at a point about 500 feet up from the mouth of the tunnel, and a depth of 100 feet will reach the tunnel level. The tunnel is being driven in comparatively easy working ground now, and it is in upwards of 750 feet.

VIRGINIA.

STAUNTON & WEST AUGUSTA RAILROAD COMPANY.—This company has been organized, with John D. Crowle, President, and W. P. Tams, Treasurer. The object is the development of the coal-fields in the northeastern part of Augusta County, 17 miles from Staunton. The capital stock is $1,000,000.

WISCONSIN.

RACINE COUNTY.

Parties from Milwaukee have organized a company to prospect for natural gas at Oak Creek, near Racine. Gas is flowing quite heavily from a well 120 feet deep, and it is proposed to sink another in a better location not far away.

WYOMING.

It is stated that an effort is now being made in New York to form a syndicate for the construction of a pipe line from the Wyoming oil fields in the Big Horn country to a point near the Northern Pacific Railway. The Standard Oil Company, it is said, has an eye on the Wyoming oil fields and is largely interested in the projected branch of the Union Pacific from Fort Fetterman, in Wyoming, to the Big Horn country known as the Midland Route.

It has also been intimated that the Northern Pacific Railroad is interested in the organization of this pipe line syndicate, the object being to shut out the Union Pacific and its connection with the Billings, Clarke's Fork & Cooke City line, which proposes to penetrate this oil region.

ASSESSMENTS.

COMPANY.	No.	When levied.	D'l'nq't in office.	Day of Sale.	Amn't per share.
Bellevue, Idaho	....	Nov. 10	*Jan.20	*Feb.20	.15
Best & Belcher, Nev	42	Jan. 10	Feb. 15	Mar. 7	.25
Blue Bird, Dak.	4	Dec. 4	Jan. 30	Feb. 15	.001
Bullion, Dak.	6	Jan. 4	Feb. 8	Feb. 25	.005
Con. Pacific, Cal.	10	Feb. 5	Mar. 11	Apr. 2	.15
Desire, Dak.	4	Jan. 3	Feb. 5	Feb. 23	.001
Goodman, Nev.	5	Jan. 15	Feb. 16	Mar. 20	.05
Gould & Curry, Nev	61	Jan. 10	Feb. 14	Mar. 7	.25
Gray Eagle, Nev.	11	Jan. 23	Feb. 26	Mar. 19	.03
Homeward Bound, Dak.	6	Jan. 12	Feb. 21	Mar. 9	.002
Imperial, Dak.	1	Jan. 2	Feb. 4	Feb. 21	.001
Iron Hill, Dak.	15	Jan. 17	Jan. 17	Mar. 9	.03
Julia, Nev.	23	Jan. 30	Mar. 7	Mar. 28	.10
Martin White, Nev.	22	Jan. 19	Mar. 6	Mar. 26	.25
May Flower, Cal.	44	Jan. 14	Feb. 18	Mar. 11	.50
Monarch, Dak.	8	Jan. 15	Feb. 8	Mar. 8	.02
Mount Terry, Dak.	1	Jan. 30	Mar. 4	Mar. 20	.001¼
Nevada Queen, Nev.	4	Dec. 21	Jan. 28	Feb. 25	.50
N. Belle Isle, Nev.	14	Jan. 3	Feb. 6	Feb. 27	.50
Occidental Con., Nev	3	Dec. 27	Jan. 31	Feb. 25	.25
Overman, Nev.	59	Jan. 15	Feb. 19	Mar. 12	.25
Peer, Ariz.	7	Jan. 28	Mar. 5	Mar. 28	.10
Piedmont, Nev.	1	Jan. 28	Mar. 6	Mar. 27	.05
Pilgrim, Mich.	....	Dec. 31	Feb. 1	.....	.50
San Francisco Nat. Gas.	1	Jan. 15	Feb. 7	Feb. 28	.25
Savage, Nev.	72	Jan. 7	Feb. 11	Mar. 4	.75
Scorpion, Nev.	24	Jan. 3	Feb. 8	Mar. 4	.10
Scott Bar, Cal.	2	Jan. 23	Feb. 26	Mar. 19	.10
SeaburyCalkins, Dak	11	Jan. 2	Feb. 5	Feb. 28	.005
Spanish R., Dak.	2	Jan. 30	Mar. 5	Mar. 20	.02
St. Louis, Cal.	2	Jan. 14	Feb. 8	Mar. 11	.05
Union Cons., Nev.	37	Jan. 4	Feb. 18	Mar. 1	.25

*Delinquent day and day of sale postponed to dates given above.

MEETINGS.

Los Angeles Mining and Smelting Company, No. 45 Murray street, New York City, March 5th, at two o'clock P.M. F. C. Harris, Secretary.

Oro Bar Mining Company, Oro Flat Mining Company, Oro Hill Mining Company. A special meeting of the stockholders of these companies will be held at No. 33 Broadway, New York City, March 14th, from twelve o'clock noon to two o'clock P.M., at which time and place an agreement for the consolidation of the Oro Hill, Oro Flat and Oro Bar mining companies will be submitted. John Humphreys, Secretary.

Radical Mining Company, Mills Building, New York City, February 20th, at one o'clock P.M.

Standard Consolidated Mining Company, No. 310 Pine street, Rooms 15 and 17, San Francisco, Cal., February 18th, at half-past one o'clock P.M. J. W. Pew, Secretary.

DIVIDENDS.

The following dividends have been declared:

American Coal Company, of Maryland, semi-annual dividend, three per cent, payable March 11th, at Room 152, No. 1 Broadway, New York City.

Aspen Mining and Smelting Company, of Colorado, dividend No. 4, twenty cents per share, or $40,000, payable February 15th, at No. 54 Wall street, New York City.

Quicksilver Mining Company, of California, one dollar and a half per share on preferred stock, payable March 15th in New York City.

MINING STOCKS.

New York.

Friday Evening, Feb. 15.

Although there has been a decrease in the volume of business in the mining share market this week, this is largely due to the cessation of the El Cristo "boom;" the tone of the market has been fully as firm as last week, a very encouraging feature being the increased inquiry from outside speculators and investors. This is an element that has long been wanting in this market, and its absence has been one of the main causes of the past year's dullness.

The market opened this week rather quietly, only 25,000 shares changing hands on Monday. On Tuesday and Wednesday the total transactions ranged from 30,000 to 35,000 each day. Thursday the greatest activity was reached, 50,000 shares being sold. To-day, for no apparent reason, there was less doing. The transactions for the week aggregate 205,194 shares.

The following new assessments have been levied: Fifteen cents a share on Consolidated Pacific, of Bodie, Mono County, Cal., and ten cents a share on Julia Consolidated, of the Virginia Mining District, Storey County, Nevada. The principal assessments pending are Best & Belcher, 25c.; Gould & Curry, 25c.; Iron Hill, Dakota, 3c.; Martin White, 25c.; North Belle Isle, 50c.; Occidental, 25c.; Overman, 25c.; Peer, Ariz., 10c.; Savage, 75c.; Union Consolidated, 25c.

The hearts of the stockholders of the Hector Gold Mining Company, of California, were gladdened this week by the announcement that an assessment of fifteen cents a share had been levied, payable within sixty days. Mr. Julius Lysynscky said to an ENGINEERING AND MINING JOURNAL reporter to-day: "This is simply another attempt at 'freeze out,' which the stockholders intend to resist. A meeting to take steps to this end will be held at the office of Mr. Hermann Cohen some day next week, and by attending this meeting and contributing 2c. a share, you can probably avert the 15c. a share." Here, Mr. Lysynscky abruptly hurried away, leaving the reporter to contemplate the enormous saving made possible by the generous efforts of Mr. Cohen.

Bodie Consolidated was neglected at $1.65.

Plymouth Consolidated was quiet at from $8.75 to $9.00.

Brunswick was one of the most active stocks on the list and advanced from 9c. to 17c., selling to-day at 15c. and 16c. It is stated that Boston parties are largely buying the stock—which for a long time has been neglected—and recently was selling as low as 5c. The sales this week amounted to 29,800 shares.

Quicksilver Preferred has declared a dividend of $1.50 per share. The stock is firm at from $37.50@$38.50. Common declined from $7.50@$7.38.

The only change in the Amadors is in Amador, which declined from $1.95@$1.80.

The interest displayed in El Cristo continues. The business, as compared with last week, shows a decrease, but the price has advanced to $1.45, and was firm all week at from $1.30@$1.45. It is understood that negotiations still continue with the view of controlling a block of this stock that is thrown on the market whenever the price rises above $1.50. Until this has been secured in some way it is unlikely that the price will advance, though this may occur at any time.

Quite a large business was done in Ontario at from $34.25@$35. Horn Silver is neglected at 80c. Stormont shows sales 2100 shares at 6c. and 7c.

There is little doing in Silver King, which sold all week at $1.10.

Rappahannock continues steady at 8c. and 9c.

Mutual opened at $1.50, but later in the week sold at $1.45.

There appears to be some misapprehension as to the future of the Helena Mining and Reduction Company, of Montana, a portion of the stock of which is held in New York. The last quotation for this stock appears on the records of the local exchange in November, 1887, at about $1.00 per share. The company of late years has suffered from lack of sufficient working capital as well as from the competition of of outside smelters, which has been made

possible by the lowering of the railway transportation rates to the mines of Butte and vicinity. Last summer Gov. S. T. Hauser, of Montana, one of the largest shareholders, secured sufficient capital from his Pacific friends to organize a new company called the Helena and Livingston Smelting Reduction Company, which now proposes to lease the entire property of the Helena Manufacturing and Reduction Company (see last week's ENGINEERING AND MINING JOURNAL). The stockholders of the latter company were allowed to come into the new organization on favorable terms, it is said, and about ninety-five per cent of them did so. It will thus be seen that, contrary to current rumor, the Helena Mining and Reduction Company has not been reorganized, and the proposed lease will, probably, increase the value of the stock instead of "wiping it out."

Mr. Theodore Sutro, President of the Sutro Tunnel Company, furnishes the ENGINEERING AND MINING JOURNAL with the following interesting figures, never before published, of the company's receipts and disbursements for the past five years:

	Receipts.	Disbursements.	Profits.
1884	$133,508.92	$95,652.55	$37,856.37
1885	193,280.25	80,085.40	113,194.85
1886	259,247.27	79,304.83	179,944.44
1887	271,313.47	98,414.53	172,898.94
1888	309,995.54	126,594.55	183,400.99

In commenting upon these figures Mr. Sutro said to an ENGINEERING AND MINING JOURNAL reporter: "The increased disbursements in 1887 and 1888 were caused by extraordinary expenses connected with the foreclosure litigation, the reorganization and issue of new bonds and the work done for mining companies, for which we received compensation, of course, such as excavating the Chollar station and the Crown Point drift. It would be a safe estimate to say that the ordinary expenses for the past two years have not exceeded $84,000 per year. This year, 1889, there will be few extraordinary expenses. The total interest charge on the new bonds, of the face value of not quite $2,200,000, will be for the first year about $88,000, but as the bonds are redeemed this amount will be steadily reduced. The receipts from royalties during January were $22,200." The stock has been quiet at from 9@11c., but the business in the Trust Certificates was large, and amounted to 54,500 shares, at prices ranging from 58@60c.

The Comstocks do not show the activity displayed in many of the other stocks, nor the advance in the price. The business was small, prices showing a declining tendency. Consolidated California & Virginia is on the downward grade, and went from $8 63@$7.75. Yellow Jacket declined from $4@$3.70. Mexican, from $3.15@$3.10. Sierra Nevada shows one sale at $3.05. Savage at $2.90. Hale & Norcross was active, but was also lower, going from $4.50 to $4. Exchequer was quoted at $1.40 and $1.45. Consolidated Imperial declined to 60c Bullion advanced from $1.45 to $1.55.

Barcelona, which advanced to 93c. last week, declined to 75c this week.

Tuscarora stocks are also neglected; Navajo is selling at from $1.45 to $1.50; North Belle Isle at $2 55; Belle Isle at 35@40c., and Commonwealth at $5.00.

The Aspen Mining and Smelting Company announces another $40,000 dividend for January, making $160,000, paid to date. The application to list this stock is still in the hands of the committee on mining securities of the Consolidated Stock and Petroleum Exchange. The committee is waiting for the report of its counsel as to the validity of title to the Aspen property before placing the stock on the list. Little Chief has continued firm at from 25@28c.; Leadville advanced from 11@13c.; Plutus shows little change at from $1.00@$1.05; Robinson was neglected at 50c.; Little Pittsburg at 8c.; Iron Silver at $3.50, and Dunkin at $1.05. Monitor was firm at 5c.; Lacrosse at 9c.; Cashier at 5@6c.

United Copper declined from $1.15 to $1 during the week, but to-day advanced again to $1.15.

Santiago shows one transaction at $3.35

Sullivan Consolidated is still booming, and the price advanced from $1.25 to $1.40, selling to-day at from $1.30 to $1.40, some 23,600 shares changing hands.

Silver Mining of Lake Valley was quiet, and was dealt in only the beginning of the week. The price declined from 52c. to 40c.

Proustite declined from $1.05 to 90c. Holyoke remains unchanged at 5@6 cents.

Homestake was lower, going from $14.00 to $13.00. Deadwood Terra shows one transaction at $1.75 and Caledonia at $2.80. Iron Hill was quoted at 20 cents.

Boston. Feb. 14.

[From our Special Correspondent.]

Copper stocks continue to rule heavy and values seem to decline, with very few reactions, while the prospect is not very encouraging for the near future. Nearly every stock on the list is lower, and unless there should be some support given to the market by outside orders, we see no reason why they will not go still lower. There are some parties who believe that the market is purposely depressed by those who are supposed to know what is going on in the syndicate, in order to get a good line of stocks at a low price, and that some day prices will go booming upward. However that may be, it is very evident at present that there are more sellers than buyers, and under such conditions there will be no advance.

Calumet & Hecla declined from $279@$269, and this morning on reports of a renewal of the fire at the mine the stock sold off to $260.

Boston & Montana declined from $53@$46 on a pressure to sell stock, but there has been good buying of it all the way down.

Quincy fell off $1, with sales at $70.

Franklin declined from $15 to $13¾, closing a little firmer at $14. Atlantic sold at $14, and Osceola declined from $17¾ to $16.

Tamarack sold early in the week at $1.50, but declined to $1.42.

Kearsarge was also weak, and sold down from $10¼ to $8½, closing a fraction better at $8¾. Butte sold at $25.

Allouez was fairly steady, at $3⅞@$4, but closed to-day at $3¾ sales.

Huron declined from $5@$4, and National was also heavy at $4½, a decline of 50 cents per share. Pewabic sold at $5@$4⅝. The last sale of this stock was December 11th, 1888, when it sold at $6.

Santa Fe has been fairly active selling up to $2⅜, with subsequent decline to $2.

Bonanza fairly steady at $1 1/16@$1⅛. Dunkin sold at 97½c., and Napa Quicksilver advanced $¼, with sales at $3½.

Balance of the list neglected.

LATER PRICES.

(*By Telegraph.*)—February 15th, 1 o'clock P. M., Calumet & Hecla, $265 bid; Quincy, $67 bid; Tamarack, $140; Kearsarge, $8; Boston and Montana, $47¾; Santa Fé, $2 1/16; Osceola, $15¾; Allouez, $3⅝ bid.

Auction Sales of Stocks.

The following securities were sold at public auction in New York City this week:

Company.	Amount sold. Shares.	Par value.	Price.
Julien Electric Co.	40	$50	$15
Standard Oil Trust	50	100	163¼
Pennsylvania Coal Co.	19	50	310½

FINANCIAL STATEMENTS.

The financial balances of the following mining companies on February 1st were as follows:

CASH ON HAND.

Alpha	$19,520.35	Julia	214.93
†Alta	63,414.21	Keyes	8,707.01
Andes	14,624.60	Kentuck	954.31
Bullion	32,542.59	Lady Washingt'n.	24,239.80
Best & Belcher	1,564.68	Locomotive	1,646.45
Bulwer	2,528.25	Mexican	3,727.80
Bodie Con.	38,419.73	Mono	15,388.01
¶Chollar	26,750.45	**Navajo	43,249.10
*Con. Cal. & Va.	96,778.03	Ophir	15,230.41
Crocker	448.75	Overman	6,480.09
Dudley	178.91	Occidental	11,547.71
Diana	4,482.35	Sierra Nevada	3,554.13
Del Monte	2,060.52	Silver King	72,000.00
Exchequer	10,146.40	Standard Con.	3,064.83
Found Treasure	246.31	Syndicate	8,870.71
††Hale & Norcross	10,591.65	Utah Con.	6,704.16
Imperial	18,883.71	Weldon	1,119.84

** In cash and unsold bullion valued at $14,696.76.

¶ In unsold bullion to offset an indebtedness of $313.48 and January's operating expenses.

* Cash in bank and unsold bullion on hand valued at $55,958.13, with further shipments to arrive before the close of the fiscal month.

† In cash and a balance of $5000 in unsold bullion.

†† In cash, with the returns of gold in the bullion and shipments yet to arrive on fiscal month.

INDEBTEDNESS.

Belcher	$7,914.15	North Belle Isle	48,187.93
Belle Isle	2,145.76	Peer	7,174.25
Challenge	2,174.12	Peerless	4,482.17
Crown Pt.	17,669.41	NorthCom'wealth	8,930.32
Con. New York	5,375.01	Potosi	21,162.63
Gould & Curry	9,923.92	Savage	57,974.93
Grand Prize	35,834.07	Seg. Belcher & Mides Con.	9,740.54
Holmes	3,253.73		
Nevada Queen	32,060.90		

Pipe Line Certificates.

Messrs. Watson & Gibson, Brokers, 55 Broadway, report as follows for the week:

The oil market has been much more active, under a preconcerted effort to bull it by a few brokers, who are acting evidently for a bull party. So far the public interest has not been enlisted, and it is not probable that outsiders will take any particular interest in the market unless it can be made so active as to invite them in. They will not go in deliberately on the statistical showing, which is, of course, very strong, and which has for over a year been equally as strong in its general character, but completely failed during this time to make a profit for any one who relied upon it. We understand that about half of the Russian oil fields and refineries are owned by the Rothschilds and they own also 200 tank cars on the Transcaspian Railway. Developments are going on in the Turkey Foot district in West Virginia. This field gives some promise. It lies in the same geological basin as the oil producing territory around Pittsburg, and it will be profitable to watch its developments. The Ohio field continues to produce daily about 30,000 barrels, a large portion of which is stored at Lima, a small portion being sold for fuel. At its price, 15 cents, we think it very much cheaper than the Pennsylvania oil at 91 cents, and if certificates were issued upon it, as they are not, we should advise its purchase for speculative accounts. We think an opportunity will be given to the public inside a year to trade in Ohio oil.

NEW YORK STOCK EXCHANGE.

	Opening.	Highest.	Lowest.	Closing.	Sales.
Feb. 9	87¼	87⅞	86¾	87¾	472,000
11	88¼	88½	87⅞	88⅜	373,000
12	88	89	87½	89	597,000
13	89	89⅞	88⅜	89⅝	534,000
14	89⅞	91⅝	89¼	91½	1,076,000
15	92	92⅝	91	91½	680,000
Total sales in barrels					3,732,000

CONSOLIDATED STOCK AND PETROLEUM EXCHANGE.

	Opening.	Highest.	Lowest.	Closing.	Sales.
eb 9	87¾	88¼	86⅞	88¼	1,051,000
11	88½	88⅝	88½	88⅝	804,000
12	8 ¼	89	87⅜	88⅝	741,000
13	89⅛	90	88⅜	89⅜	1,265,000
14	89¾	91¾	89¼	91⅝	2,408,000
15	91⅞	92¼	91	91⅝	1,271,000
Total sales in barrels					7,540,000

Electric Stocks.

The following are the latest quotations, prepared exclusively for the ENGINEERING AND MINING JOURNAL by Messrs. Crosman & Quick, brokers, New York City:

Stocks.	Par value.	Market price.
Edison	$100	$197 @$200
" Illuminating	100	94 @ 96
Brush	100	.. ..
" Illuminating	100	80 @ 95
United States	100	35 bid ..
" " Illuminating	100	50 bid ..
Daft	100	40 @ 60
Consolidated	100	51
Westinghouse	50	42 @ 43

The annual meeting of the stockholders of the Westinghouse Electric Company was held at Pittsburg, Pa., on the 11th inst. George Westinghouse, Jr., read a statement in which he announced that a meeting would be held at a future date, when complete information regarding the combinations made in 1888 would be given. It was stated that during 1888 the Westinghouse Company had acquired, by lease, the control of the Consolidated Electric Light and the Sawyer-Man Electric companies, the lease taking effect October 1st. The Westinghouse Company owns $1,235,000, par value, of the capital stock of the Consolidated Company, the capital of which is $2,500,000. In November the Westinghouse Company acquired the capital stock ($135,000) and outfit of the Waterhouse Electric and Manufacturing Company. In January of the present year an agreement was entered into with the principal owners of the United States Electric Lighting Company, whereby the Westinghouse Company purchased seven-fifteenths of the stock.

Trust Stocks.

The following are the latest quotations prepared for the ENGINEERING AND MINING JOURNAL by Messrs. C. I. Hudson & Co., Brokers, New York City:

Stock.	Par value.	Market price
White Lead Trust	$100	$14 @$16
Standard Oil Trust	100	163 @165
Sugar Refineries Trust	100	85½@ 86
Whiskey Trust	100	32 @ 33

Domestic and Foreign Coin.

The following are the nominal quotations representing the price for American and other coin:

	Bid.	Asked.
Trade dollars	$ .72	$ —
Mexican dollars	.72½	.73½
Peruvian soles and Chilian pesos	.71	.72
English silver	4.82	4.87
Five francs	.94	.95
Victoria sovereigns	4.86	4.90
Twenty francs	3.87	3.90
Twenty marks	4.74	4.80
Spanish doubloons	15.60	15.75
Spanish 25 pesetas	4.80	4.90
Mexican doubloons	15.55	15.70
Mexican 20 pesos	19.50	19.65
Ten guilders	3.96	4.00

London Stock Market.

The Secretary of the Bolivian Silver Company, Limited, desires us correct the statement made in our issue of December 29th, 1888, that "this company is evidently the creation of Bewick and Moreing." Mr. Bewick is only a director and Mr. Moreing Consulting Engineer.

COAL TRADE REVIEW.

NEW YORK, Friday Evening, Feb. 15.

Statistics.

PRODUCTION OF ANTHRACITE COAL for week ended February 9th, and year from January 1st.

Tons of 2240 lbs.	1889. Week.	1889. Year.	1888. Year.
P. & Read. R.R. Co.	93,018	694,838	120,000
Cent. R.R. of N. J.	70,857	550,361	471,939
L. V. R.R. Co.	110,018	791,330	484,110
D., L. & W. RR. Co.	76,092	377,441	849,540
D. & H. Canal Co.	58,725	399,339	526,519
Penna. R.R.	49,896	307,193	414,148
Penna Coal Co.	17,230	75,202	168,526
N. Y., L. E. & W.	12,000	72,000	92,165
Total	487,836	3,268,704	3,126,947
Increase		141,757	

The above table does not include the amount of coal consumed and sold at the mines, which is about six per cent of the whole production.

Production for corresponding period:

1884	3,217,545	1886	3,471,063
1885	2,852,898	1887	3,046,767

PRODUCTION OF BITUMINOUS COAL for week ended February 9th, and year from January 1st:

EASTERN AND NORTHERN SHIPMENTS.

Tons of 2240 lbs.	1889. Week.	1889. Year.	1888. Year.
Phila. & Erie R.R.	1,307	9,685	4,118
Cumberland, Md	60,000	335,619	351,992
Barclay, Pa.	3,000	17,414	18,573
Broad Top, Pa.	7,115	52,062	41,871
Clearfield, Pa.	43,138	386,092	404,722
Alleghany, Pa.	15,092	108,028	93,434
Pocahontas Flat Top	29,003	154,482	156,355
Kanawha, W. Va.	27,202	173,734	174,998
Total	185,857	1,237,116	1,246,063

WESTERN SHIPMENTS.			
Pittsburg, Pa.....	12,325	72,883	90,391
Westmoreland, Pa.....	41,919	212,775	156,609
Monongahela, Pa.....	2,707	17,913	41,222
Total.....	56,951	303,571	288,222
Grand total	242,808	1,540,687	1,534,285

PRODUCTION OF COKE on line of Pennsylvania R.R for week ending February 9th and year from January 1st, in tons of 2000 lbs.: Week, 84,605 tons; year, 525,270 tons; to corresponding date in 1888, 482,712 tons.

Anthracite.

Notwithstanding the colder weather the anthracite market is weaker and approaches demoralization. Prices are purely nominal, for though the companies will name nothing but their circular rates, it is nevertheless true that company coal can be purchased at less than these. Sometimes it is "coal afloat;" some times "stock coal," but the net result is that most of the companies' coals can be purchased considerably off from schedule prices.

At the meeting of the sales agents of the companies this week, there was considerable discussion and some little dissatisfaction on account of the restriction in output; some even wanted the prices to be reduced. Nothing, however, was done in either direction further than to adjourn these questions to a meeting to be held two weeks hence, unless it be called before that date by the chairman. The mere fact that it was deemed possible that a meeting might be called in the interval of two weeks points to a certain degree of instability in the market. As it is, no buyer of any account is deceived by the statement that companies' prices are being obtained, for every one goes shopping, and it requires but a few calls to find out how the market stands. It is understood that there will be a considerable reduction of prices for the opening of the spring trade. It is not decided when this opening price will be made, but we think it would be greatly in the interest of the trade if it were announced at an early date. The 1st of March would not be too early to put in force the spring opening rates, and if these be at once put down to a reasonable figure with the accompanying statement that the prices so named will be the lowest of the year it would probably induce an earlier buying than would otherwise take place. What prices should be named for the spring opening is a question which receives different answers, according to the temperament or interest of the party discussing it—$4 for stove and chestnut has been named by certain well informed parties as a possible figure, but $3.75 has been mentioned by some of the most experienced men in the trade as a safer and better figure on which to start the market with the view of having the trade make purchases early. It would, we think, be better to start low, and increase the price more frequently than to start high, and keep the price unchanged. In the former case no doubt a good deal of buying would take place with the view of making a profit on the investment, while in the latter case every purchaser will hold off as long as he possibly can and leave the companies to hold the coal or to curtail production from the very start.

Individual operators, even such firms as Pardee & Co., do not pretend to stick to circular rates. We may quote as fair ruling prices to-day: Stove coal from $3.75 to $4; chestnut about 10c. below stove; egg $3.45 to $3.60, and broken, perhaps $3.50 to $3.75. Broken appears to be in better demand than egg coal. Pea coal is worth about $3.

Coxe Brothers & Company's suit against the Lehigh Valley Railroad Company was concluded, so far as taking of testimony is concerned, early this week, and is to be argued on the 1st of March. Each side is confident of securing a decision in its own favor. The testimony which has been published is very incomplete and it scarcely gives an idea of what was actually said. Coxe Brothers & Co. state that their entire net profit was less than $7000 on a production of 1,140,000 tons in 1888 while the Lehigh Valley Coal Co. which mined and sold 1,201,416 tons in 1887 made a net profit of $337,588, and in 1888 made a profit of $434,466, on an output of 1,455,104 tons. There is evidently some item in one of these calculations that does not appear in the other; possibly the Lehigh Valley Coal Company does not charge the mines with royalty, while Coxe Bros. & Co. are operating leased mines and pay quite a high royalty. Even this would not explain the difference.

Bituminous.

There is little to report in this article. The Seaboard Association has made but little progress during the week, though it is practically organized and the agreement will, no doubt, go into force. The competitive trade has been fixed at 5,500,000 tons for the season and prices will remain as they were last year.

The decision in the case of Coxe Bros. & Co. will probably have as great an interest to the bituminous miners as to the anthracite, but the prices which are now named are not capable of standing any higher rate of transportation if the mining companies are to come out with any profit at all at the end of the season.

BOSTON. Feb. 14.

[From our Special Correspondent.]

The anthracite coal market has just begun to feel the effects of the cold weather in a wholesale way, but a week or ten days more of this weather will surely bring along some orders. Trade is therefore as dull as ever, but jobbers are not feeling quite so blue. Coal can be bought for a very low price. The buyer can practically make his own terms, everything depending upon the size of his order and the readiness with which he can take the coal. Stove coal can be had as low as $4.00 f.o.b. at New York, and very fair stove coal at $4.10; egg coal runs from $3.75 to $3.85 on individual coal. There is less pressure to sell broken, and $3.75 is about as well as can be done on that size.

Bituminous coal is without movement. The pool prospects are getting to be the absorbing topic of the hour, and further, if not final, particulars are looked for within a week. It is understood that f. o. b. prices will remain as last year, $2.54 to middle men and $2.60 to the general trade. The vexed question is as to the mining percentages. All the important operators are in the arrangement and many think it will be more of a success than the 1888 pool. The trade here is not driving up business for two reasons: consumers don't want to contract now for soft coal, nor before April in most cases, and secondly, the early birds, or some of them at least, who went out for the worms last season, caught boa constrictors instead of worms.

The freight situation continues more in shippers, favor. Large vessels can be had at Baltimore for $1.15 and 90 cents to Sound ports. At New York 90 cents rules for barges and from that up to $1.15; Philadelphia rates are firm at $1.25. Skippers avoid the fresh water ice of the Delaware in winter. The dearth of orders is the main reason for the low rates.

Retail trade is unchanged as to rates, but there is more business reported.

Receipts for the week were 11,942 tons anthracite and 40,424 bituminous, or a total so far in 1889 of 84,459 tons anthracite and 120,859 tons bituminous.

Great interest is felt here in the case of Coxe Brothers before the Inter-State Commerce Commission.

BUFFALO. Feb. 14.

[From our Special Correspondent.]

There is nothing to impart to your readers on the bituminous and anthracite coal trade relative to supply, demand or quotations.

No news with regard to the contract of the Grand Trunk Railway Company.

Many of our dealers in and producers of coal are missing from our city, and the inference is that they are enjoying the Montreal Carnival and combining business therewith.

The Delaware, Lackawanna & Western Company's coal business, has expanded very much the past two years and the probabilities are that a further increase may be looked for this year. As an illustration of what the managers are doing, the last bent in the Lackawanna trestle at the foot of Erie street was raised yesterday. There are 3,600,000 feet of lumber in the trestle and the capacity is 4600 tons. It is 1154 feet long, 45 feet wide, and the highest bent is 51 feet, and the lowest 42 feet. There are three tracks on the trestle, and three boats may be loaded at once from the 46 pockets.

Stringent measures are now being taken by the several coal carrying companies at this port to break up the system of petty stealing of coal from the cars and pockets of the trestles. In the aggregate, thousands of dollars are lost to the companies annually by these depredations.

Presume you will refer to the Coxe Bros.' case relative to discrimination in railroad freights by the Le high Valley against that firm, therefore will not make further comment, except to say that the proceedings are watched with much interest by our coal men.

A bill has been introduced into the Legislature authorizing the city of Lockport, N. Y., 20 miles from Buffalo, to raise the sum of $30,000 to purchase an electric light plant. Our neighbors are tired of coal gas on two scores—cost and inefficiency of illumination.

PITTSBURG. Feb. 14.

[From our Special Corespondent.]

Coal.—We have very little that is new or important for our readers. A portion of the mines on the Monongahela have started at the old price; how long it will continue is not difficult to guess. With coal selling at Cincinnati at 4½@5 cents per bushel, and 3 cents for mining makes a balance on the wrong side of the ledger. The pools are frozen on the Monongahela. Unless a thaw comes soon mining will not hold out long.

The nominal rates are:

PRICE OF COAL PER 100 BUSHELS = 7600 LBS.			
First pool.....	$4.75	Fourth pool	$3.25
Second pool.....	4.50	Railroad coal	5.00
Third pool.....	3.90		

Connellsville Coke.—We hear a good deal about a coke strike: so far, however, it has begun and ended in the newspapers. Leading coke men report matters moving along in good shape. The talk about a strike gives them no uneasiness. Seventy-seven coke plants in the Connellsville region show 12,551 ovens in operation, 710 idle and 720 in process of erection. Production, 103,233 tons; falling off compared with preceeding week, 7725 tons. Shipments last week 5600 cars; previous week 5950 deficiency, 350 cars.

Nominal rates at the ovens:

Furnace Coke....	$1.25@$1.35	Foundries.....	$1.50
Crushed.....	2.20		

Freight rates from ovens to Pittsburg, 70c. per ton; to the Matoning and Shenango valleys, $1.35; East St. Louis, $3.20; Cleveland, $2.80; Chicago, $2.75.

FREIGHTS.

Freights from Pittsburg to the Northwest.—The freight rates on iron articles from Pittsburg to all points between St. Paul, Minneapolis and Minnesota Transfer were advanced last week from 2 to 3 cents per 100 pounds. White lead and paints were also advanced about the same.

Freights on Ore.—It is reported that contracts have been closed between a large ore company in Cleveland and the Northern Steamship Company, owned by President Hill, of the Manitoba Railroad Company, for the transportation of ore freights for the next season from the head of Lake Superior to Lake Erie ports at $1.25 a ton.

The following were the rates per ton of 2240 lbs. for the last coal charters:

From Philadelphia to:—Bangor, 2.00*; Boston-1.60@1.70*; Charleston, 1.00; Chelsea, 1.55@1.60*; Com, Point, Mass., 1.60*; E. Boston, 1.70*; East Cambridge, 1.50*; Fall River, 1.15@1.25*; Galveston, 3.00*; Gardner, Me., 1.60*‡; Georgetown, D. C., 1.00; Lynn, 1.75@1.85*; New Bedford, 1.15@1.25*; Newburyport, 1.75*; New York, .90†; Norfolk, 1.60@1.70*; Portland, 1.60@1.70*; Portsmouth, N. H., 1.60@1.70*; Portsmouth, Va., .65; Providence, 1.35@1.40*; Richmond, Va., 1.00; Rockport, 1.22½*; Saco, Me., 1.75*; Salem, Mass., .90*; Savannah, 1.25; Washington, 1.00; Weymouth, 1.15*; Wilmington, N. C., 1.15.

From Baltimore to:—Bangor, Me., 1.60; Bath, 1.60; Boston, 1.25; Bridgeport, Conn., 1.00; Bristol, 1.25@1.30; Brooklyn, 1.00; Charleston, 90c.; Fall River, 1.00; Galveston, 3.00; Gardner, Me., 1.75; New Bedford, 1.00; Newark, N. J., 1.00; Newburyport, 2.25; New Haven, 1.00; New London, 1.00; New York, 1.00; Portland, 1.25; Portsmouth, N. H., 1.65@1.75; Providence, 1.25@1.40; Quincy Point, 1.50; Richmond, Va., .70 Roxbury, 1.50 3c.; Salem, Mass., 1.25; Savannah, 1.25; Somerset, 1.25@1.30; Williamsburgh, N. Y., 1.00; Wilmington, 1.35.

From New York to:—Bangor, Me., 1.25@1.30*; Bath, 1.30@1.40*; Beverly, 1.15*; Boston, 1.25*; Bridgeport, Conn., .60; Cambridge, Mass., 1.15*3c.; Cambridgeport, 1.10*; Charlestown, 1.10*; Chelsea, 1.10*; Com. Pt., Mass., 1.15*; E. Boston, 1.15*; E. Cambridge, 1.15*. Fall River, .75@.90; New Bedford, .80@.90; Newburyport, 1.25*; New Haven, .60; Newport, .75@.90; New London, .85; Norwalk, Conn., .60; Portland, 1.10*; Portsmouth, N. H., 1.20*; Providence, .75@.90; Salem 1.15*.

* And discharging. 3c. per bridge extra. † Alongside. ‡ And towing.

METAL MARKETS.

NEW YORK, Friday Evening, Feb. 15, 1889.

Prices of silver per ounce troy.

Feb.	Sterling Exch'ge.	Lond'n Pence.	N. Y. Cts.	Feb.	Sterling Exch'ge.	Lond'n Pence.	N. Y. Cts.
9	4.88	42⅛	92¾	13	4.88¼	*	†
11	4.88¼	42⅛	92⅞	14	4.88¼	42 9-16	93
12	4.88¼	42⅜	93⅛	15	4.88¼	42 9-16	93

* 42⅜ to 42 9-16. † 93 to 93⅛.

London market continues quiet with limited orders. There was a slight rise first of week, perhaps due to Germany taking up the silver question.

High rates of interest continue in India, with consequent manipulation of silver for remittances.

The United States Assay Office at New York reports total receipts of silver for the week, 106,000 ounces.

Foreign Bank Statements.—The governors of the Bank of England at their weekly meeting made no change in its rate for discount, and it remains at 3 per cent. During the week the bank lost £243,000 bullion, and the proportion of its reserve to its liabilities was reduced from 47·26 to 44·85 per cent, against an advance from 44·91 to 46·35 per cent in the same week of last year, when its rate for discount was 2½ per cent. Thursday the bank lost £7000 bullion on balance. The weekly statement of the Bank of France shows a gain of 1,625,000 francs gold and a loss of 700,000 francs silver.

Copper.—The past week has brought about no change of importance in the condition of the copper market. The feeling of uncertainty and distrust mentioned in our last report is still as evident as ever, and the business taking place in the open market is so limited as to be hardly worthy of reporting. Prices of Lake copper remain nominally at 17. Spot, 16·50 March, 16·50 April, 16·50 May, and for casting kinds it is reported that as low as 15½c. is being accepted.

The statement is made, and generally credited, that the French Syndicate has recently concluded a pool sale to the consumers for the next three months (March, April and May), and at a price understood to be 16½c. per pound. Regarding the total quantity embraced by the new sale, opinions are somewhat conflicting, but we hope to be able to give the correct figures in our next report.

In the London market very little business is doing, and consumptive demand is reported as stagnant. The syndicate is still supporting the market for spot G.M.B. and Chili bars by combining their buying policy, but three months futures can only be placed at a very serious concession. The latest cable quotations for spot Chili bars and G.M.B. warrants is £77 10s., whilst three months futures are quite normal, and could not be sold above £69 to parties not identified with the syndicate, whose representatives are bidding £73 10s. Refined descriptions are reported as irregular with tough cakes quoted £78 to £78 10s., and best selected at £79.

The exports of copper from New York during the past week were as follows:

To Liverpool—	Copper matte.		Lbs.	
By S.S. Germanic.....	Bags.	722	72,200	$7,000
By S.S. England.....	Sacks.	6,511	766,130	38,300
By S.S. Wyoming.....	Bbls.	212	217,003	12,000
To Liverpool—	Copper.			
By S.S. Germanic.....	Casks.	3	6,300	1,100
By S.S. Wyoming.....	Bbls.	40	50,000	8,500
By S.S. Egypt.....	Casks.	315	337,500	54,000

Messrs. James Lewis & Son report under date, Liverpool, February 1st, as follows:

"The great uncertainty with regard to future values effectually prevents the revival of any consumptive demand, which has practically ceased during the past three months, the only sale of manufactured copper of any moment reported being that of that of 1000 tons of tons of yellow-metal for India at 7d. per pound.

"This uncertainty has also had a very detrimental effect on the shares of the Société des Métaux and of the various copper mining companies. The shares of the former fell from 842.50 francs on the 1st ultimo to 460 francs on the 29th, while the shares of the Rio Tinto Company fell during the same period from £25½ to £19, the total depreciation in the market value of the shares of the three Spanish and two Cape companies amounting altogether to about three and a quarter millions sterling.

"A very noticeable feature is the large quantity of English good merchantable copper sent into the public stocks, amounting to 1988 tons the past month, and bringing the total quantity up to 6501 tons. From this it is evident that smelters are unable to sell to consumers, and therefore return to the syndicate, in this form, the copper purchased from them and from independent producers as furnace material.

"Considerable excitement was caused by the sale on the 26th ultimo of a cargo of Cueva de la Mora precipitate at 15s. per unit, the syndicate claiming it under a verbal contract for the whole of the company's production at 13s. per unit. They failed, however, to obtain an injunction to prevent its delivery to the purchasers.

"The public stocks show an increase for the month of 8265 tons, and the visible supply of 5548 tons. Imports are 973 tons greater than last year, and deliveries 3809 tons less.

"The arrivals in England from Chili during the month have been 2420, and the deliveries 272 tons fine, and from other countries 6241 and 2246 tons fine, respectively.

"The arrivals in Liverpool and Swansea, from the United States, have been 195 tons ingots, 4372 matte (including 3830 tons Anaconda), 18 ore, and 18 precipitate, equal to about 2778 tons fine copper, and in France nil.

"The Chili Charters for the month are 1900 tons, and the closing rate of exchange is 29⅝d., bars being $24.50 per quintal.

Tin.—The course of this market has again been rather erratic during the past week. The market opened a little easier on Monday, and continued rather dull up to Wednesday, when a better tone became manifest, and quotations advanced somewhat. Since then, however, on weaker reports from London, prices here have again suffered, and our closing quotations are: Spot, 21·30; March, 21·35; April, 21·40. London prices have declined during the week from £95 10s. to £95 15s., as last reported, to £94 12s. 6d. to £94 15s.

The present movements in the tin market seem to be caused by the principal operator in this metal evidently with the object of shaking out the smaller operators and thus securing a better control. Consumption continues very fair and the position generally is healthy, and we shall not be at all surprised to see higher prices ruling before long.

Lead.—During the week the lead market has been very lifeless, with business quite nominal. Nothing has been reported during the last few days with the exception of a sale of about 100 tons at 3·65, at which figure, however, there are a good many buyers with no more sellers. These now hold out for 3·70. Consumers appear to be well supplied for the time being, and under these circumstances it is not likely that any important rise in prices will take place, and we may yet witness a further decline in view of the large stocks still held in this city and other places, which effectually discourage anybody from attempting to put the market up.

The Chicago Market.—Messrs. Everett & Post telegraph us to-day as follows: Market very quiet; 3·45c. asked. Sales for the week sum up 500 tons.

The St. Louis Market.—Messrs. John Wahl & Co telegraph us to-day as follows: The market has ruled with scarcely any fresh business since our last report. Common could not be placed at 3·40, and refined is not wanted at 3·45.

Spelter is dull and rather weaker again and demand has slackened considerably, but better prices are confidently expected before long. We quote to-day prime Western at 4·90.

Production of Zinc in 1888 in the United States.—We are indebted to the courtesy of Mr. Charles Kirchhoff, Jr., agent of the Geological Survey, for the following advance copy of the statistics of zinc production in 1888. The total found by Mr Kirchhoff, 55,913 tons, varies but about 1000 tons from the figures published in these pages January 12th. The production of spelter in the United States for 1888 is estimated as follows, the unit being the ton of 2000 pounds:

Illinois, 22,445; Kansas, 10,442; Missouri, 13.465; Eastern and Southern States, 9561. Total, 55,913.

The total for 1888 includes the returns from every works in this country, with the exception of a small concern in Colorado. New works and additions to old concerns, in the West, East and South, the influence of which has not been felt in 1888, or has been only small, promise to lead to a further increase of production during the current year.

Antimony.—The demand for this metal is very satisfactory, and quotations are well maintained at 11⅛ for Hallett's and 13⅛ for Cookson's.

Nickel remains unchanged, at 60@61c.

IRON MARKET REVIEW.

NEW YORK, Friday Evening, Feb. 15.

The general features of the iron market have not perceptibly changed since our last report. Prices are nominally the same as quoted a week ago, though the cheerless feeling in the market seems to intensify. It is true the Thomas Iron Company has entered up orders for pig iron from its old customers to the amount of 120,000 to 130,000 tons at $18 for No. 1 X, $17 for No. 2 X, $16 for No. 2 plain, and $15.25 for forge. These prices are purely nominal, and are not considered of any great importance in fixing the price of iron in the trade, for it is well known that the policy of the Thomas Iron Company has been to protect its customers and if any iron is offered below the price at which their orders have been booked the company promptly reduces the price to them, at whatever price their orders have been entered. It is to be hoped that these prices can be maintained, but this is no more certain than it was a week ago, before the Thomas Iron Company had announced their figures. Southern irons are still offered considerably below these figures, but there is not a great deal of it now pressing on this market, and it may be that the partial success of the storage warrent scheme may relieve the market of some of the pressing lots which have tended to lower prices. As we have stated on many occasions, the strong point in the market is the extremely small stock now being carried in this country, and the weak point lies in the financial necessities of some of the furnaces. We quote No. 1 X standard brands $17@$18; Foundry No. 2, $16@$17, and Forge, $15@$15.50, tide-water delivery.

Scotch Pig.—There is no nominal change in prices, but arrivals are very light, and the market has a stronger tone than a week ago. Coltness we still continue to quote at $20 to $21; Shotts, $20 to $20.50; Summerlee, $20 to $20.50, and Dalmellington, $19.25. Freights continue at about 3s. 6d. to 4s. The Scotch market is somewhat stronger, Coltness being quoted to-day at at 52s. 3d; Summerlee, 50s. 6d.; Gartsherrie, £48 6s. 9d., and Eglinton, 42s. 6d. Scotch Warrants are quoted at 41s. 10d., which is only about 1s. 6d. above their quotation at the corresponding period a year go.

Structural Iron and Steel.—In structural iron we hear a good deal of business being talked of, but there is nothing new to report in actual transactions. Prices remain as quoted last week, and will be found in our usual table of current prices on another page.

Steel Rails—We still hear of very low prices, $26.50 having been taken for a resale of a 5,000 ton lot during the week. We still continue to quote $26.50@$27.50 at the Eastern mills, $27 being practically the price which can be obtained anywhere east of Chicago.

Tool Steel.—The price of this article has been on the down grade for the past few weeks. The usual price-lists have been lost or forgotten and concessions are made to large buyers in an alarming manner.

Old Rails.—There is but little doing in these. Stocks are small and are held firmly. We quote from $23 to $24.

There is no change in other articles on our list, which we continue to quote in our table of Prices Current as heretofore.

LOUISVILLE. Feb. 12.

[Special report by Messrs. HALL BROTHERS & Co.]

There have been some very nice orders booked, ranging from car-load lots to 200, 500, 1000 and 1500 ton lots, mostly silvery and bright irons. Most of the leading furnaces are out of the market on mill and foundry grades, having booked orders sufficient to cover them for several months. Buyers seem to think that the market has about touched bottom, and there are frequent inquiries for standard irons, but the prices rule about the same. Quotations, which are for cash f.o.b. cars at Louisville, will be found in our weekly register of prices.

PHILADELPHIA. Feb. 15.

[From our Special Correspondent.]

The tendency in the iron trade is still said to be downward, but a comparison of sales made this week with sales made last week shows that there is no absolute difference in selling prices. Buyers of pig-iron are purchasing in a retail way, and makers and agents of makers find it impossible to close large transactions for future delivery. The blast furnace managers are quite ready, and in fact, anxious to sell for Spring and Summer at the prices they are now naming, but they have not met with any encouragement since the first of the month. On the other hand, a great deal of iron is being melted up, and stocks among consumers everywhere are light. Makers think this unsatisfactory condition of trade will not continue much longer. All of the special makes are sold up, and at full prices. Southern iron is still being offered here, but not taken to any extent. In some quarters it is very confidently expected that there will be an upward tendency within thirty days. Brokers report no movement in foreign iron. Quotations for spiegeleisen continue unchanged.

The business at the bloomaries is still quite active and none of them are complaining of dullness. A better business has been done during the past six days in muck bars and the demand has had a good effect upon prices, arresting the downward tendency in the various markets.

Manufacturers of bar iron from the interior are reporting a good demand this week, but city mills and store keeping trade is light. Some manufacturers do not care to take very heavy orders at the prices which buyers are offering. They think that improvement of from one to two dollars will develop itself by the opening of spring. They are not encouraging very heavy business though ready to take it if their terms could be accepted. The large business anticipated in skelp iron has not been closed.

Nails are doing some better, and store-keepers have decided to take advantage of some shadings made last week. The pipe makers are booking a little more business. The distribution of sheet-iron from stores has been quite active for a week or two past. No change in prices.

The Eastern Pennsylvania plate-iron makers report a great irregularity this week in plate and tank iron which they explain is caused by the shading of prices by Western Pennsylvania makers, who have been scouring around, and have secured a good deal of the business coming from this end of the state. Agents who are looking up business report a large amount in sight.

A great deal of structural iron business is also about being placed. The bridge builders also figure upon large lots, and some brokers here say that several large buyers will close before the end of this month. Prices have been hammered down pretty well. Steel rail makers are refusing to accept offers at 50 cents to $1 below their bottom price. Old rails are dull, buyers refusing to pay the asking prices except in isolated cases. The scrap dealers are gathering all the choice lots they can to cover orders that have been recently received.

Quotations will be found in our table of current prices.

PITTSBURG. Feb. 14

[From our Special Correspondent.]

Raw Iron.—The market continues in a very unsatisfactory condition. There is, evidently, a want of confidence among consumers as well as producers as regards the present and future of iron. There are two sides, and both parties are disposed to argue from their own standpoints. Buyers can see nothing ahead except a declining market and lower prices in the near future, at the same time not looking things square in the face. A little investigation on their part would soon discover that there is no money in pig iron at present prices. We noticed in the ENGINEERING AND MINING JOURNAL, a couple of weeks ago, an announcement that Eastern furnaces had reduced the price of gray forge to $15.25, tide-water delivery. At this so-called reduction, then, rates are about 75 cents above Pittsburg prices. Some parties don't know when they have a good thing; in fact, don't make the discovery until it is too late.

The general opinion is that prices have about reached the lowest point. We have heard of several round lots of gray forge that could have been disposed of provided holders would concede 25 cents per ton. The holder said "no further concessions will be made." On the whole, prices are about the same as last week although they are steadier. It is thought that the extreme limits have been reached in the way of concessions. The reactionary impulse is anxiously waited for, and is generally believed to be not far off, although, as above noted, it is for the present a matter of faith and hope rather than one of actual reality.

Parties who ought to be well informed, who have been making particular inquiries, say the stock of raw iron, both foundry and forge, in the hands of consumers is daily being reduced, so that they will soon be on the market for fresh supplies. The following sales will show how the Pittsburg market stands:

Coal and Coke Smelted Lake Ore.

2000 Tons Bessemer	16.75 cash.
1000 Tons Bessemer	16.80 cash
1000 Tons Bessemer	16.75 cash.
1000 Tons Gray Forge	14.50 cash.
1000 Tons Gray Forge	14.50 cash.
1200 Tons No. 1 Mill	15.00 cash.
1000 Tons Gray Forge, City Furnace	14.50 cash.
1000 Tons Gray Forge, City Furnace	14.50 cash.
700 Tons Gray Forge	14.50 cash.
1000 Tons Bessemer	16.50 cash.
200 Tons Gray Forge	15.60 cash.
100 Tons No. 2 Foundry	16.00 cash

Coke, Native Ore.

500 Tons Gray Forge	14.50 cash.
100 Tons No. 2 Foundry	16.00 4 mo.
100 Tons No. 2 Foundry	16.25 4 mo.
50 Tons Silvery, Extra	19.00 cash.
50 Tons Silvery No. 2	16.50 cash.

Charcoal.

700 Tons Cold Blast	24.00 cash.
75 Tons No. 2 Foundry	22.75 cash.
50 Tons No. 2 Foundry	22.50 cash.

Muck Bar.

300 Tons Neutral, Spot	26.75 cash.
300 Tons Neutral, Spot	27.00 cash.
1000 Tons Neutral, March and April	27.50 cash.

Old Iron Rails.

500 Tons American Ts	23.25 cash

Ferro-Manganese.

150 Tons 80 per cent	57.00 cash.

Skelp Iron.

1500 Tons Wide Grooved, per 100 lbs.	1.65 cash.

Steel Billets.

500 Tons Billets	28.00 cash.
500 Tons Billets	27.50 cash.

Steel Bloom Ends.

500 Tons Bloom Ends	18.00 cash.

Steel Wire Rods.

350 Tons American Fives	41.00 cash.

Scrap Material.

300 Tons Cast Scrap, Gross	16.00 cash.
200 Tons No. 1 Wrought Scrap, Net	21.00 cash.
200 Tons No. 2 Wrought Scrap, Net	19.00 cash.
200 Tons Cast Borings, Gross	12.50 cash.
200 Tons Wrought Turnings, Net	14.00 cash.
150 Tons No. 1 Cast Scrap, Gross	15.75 cash

CHEMICALS AND MINERALS.

NEW YORK, Friday Evening, Feb. 15.

Heavy Chemicals.—Prices still drooping, no improvement in the demand, a few lots still on the docks pressing for sale, and no positive indications of a revival of activity in the near future are the main features of the market for heavy chemicals this week. The announcement that the caustic soda makers have decided to restrict their output 25 per cent again this month, to which our Liverpool correspondents refer below, should naturally have a strengthening effect on values, but if it proves as ineffective as the restriction last month, the market will receive very little benefit from it, indeed. Prices for both spot and futures for all articles continue depressed.

Carbonated soda ash, 48 per cent, is only in moderate request, the transactions reported being principally of the hand-to-mouth order. For large or medium quantities 1·25c. is asked. Caustic soda ash, 48 per cent, is in about the same position, at very nearly the same figures, ranging from 1·25c. to 1·30c., according to quantity. In this, as in all the other articles that may be appropriately classed under the head of "heavy chemicals," there is a disposition on the part of holders to make concessions in order to secure business. This is, doubtless, attributable to the heavy speculative buying which was done last fall, when the prospects for 1889 were exceeding bright, by several importers here who have lately manifested a disposition to unload that has had a demoralizing effect on prices and on the market generally.

Caustic Soda.—Prices are quoted still lower this week. All of the higher tests, 70, 74 and 77 per cent, may be purchased at 2·20c., and it is even stated that orders could be filled at 2·17½c. For 60 per cent, the nominal quotation is 2 40c.

Sal-soda is dull at the unusually low prices of 85c. for English, and 80c. for American.

Refined alkali is likewise quiet at 1·15c.@1·17½c. for 58 per cent., and 1·22½c. for 48 per cent.

Bleaching powder is slow of sale, owing to the continued over supply on the spot; fair prices are 1·80c.@1·82½c. on the spot, and 1·75c@1·77½c. for futures.

Acids.—The principal event of the week was the destruction by fire, on Sunday last, of works of the Highland Chemical Company, in Putnam County, N. Y., which was engaged mainly in manufacturing muriatic and sulphuric acids. We were informed at the office of the company to-day that the total loss was $70,000, in addition to $22,000 covered by insurance, and that the company intend to rebuild immediately. They hope to have their muriatic plant running in about three weeks. Rumor has it that the condition of the acid trade at present is not such as to invite any such expeditious work as this. However this may be the effect on the market, as yet, has been very slight, and we are unable to learn of any consequent stiffening of price or increase of business among the other manufacturers.

Acetic is dull at 2c. Muriatic acid, although no advance has been made, is at all events firm at the old figures, ranging from 1·15@1·20c. for 18° to 1·40@1·80c. for 22°. Nitric may also be written firm at unchanged prices. Oxalic acid is steady at 9½@10½c., according to quantity, for prime English and German make ex store or dock, New York, Boston and Philadelphia. A fair demand is reported for sulphuric acid at 95c. for 66°.

Fertilizers, Etc.—The failure of the Pacifics Guano Company, owners of large phosphate deposits at Beaufort, S. C., and of works in Massachusetts, in Boston, last week, with liabilities of a $1,000,000, had a rather disturbing effect on the market for crude fertilizer materials in this city for a few days this week. Buyers for a time were cautious and hesitated before placing their orders, but as it now appears that this failure was caused by outside speculation and as no more are likely to follow, this feeling seems to have passed away and orders are coming in quite freely. It is an encouraging indication of the strength of the market that prices have not suffered to any appreciable extent. We continue to quote: Azotine, $2.75; dried blood (city), low grade, $2.70 per unit; Western high grade, $2.75 per unit for ground material; tankage, high grade, $25@$26 per ton; low grade, $24 per ton, as to quality. Fish scrap $25 per ton f.o.b. factory. Sulphate of ammonia, $3.40 per cent.

Refuse bone-black, guaranteed 70 per cent phosphate, is quoted at $19.50 per ton. Dissolved bone-black is 95c.@$1 per unit for available phosphoric acid, and acid phosphate 85@90c. per unit for available phosphoric acid.

Steamed bones, unground, $19; ground, $25@$26.

Charleston rock, undried, $5 per ton; kiln dried, $6 per ton, both f.o.b. vessels at the mines. Charleston rock, ground, is held at $10@$10.50 ex steamer at New York.

Muriate of potash continues in light supply on the spot, and rather firm at the following prices: 1 85@1·90c., on the spot, according to quantity; to arrive by steamer, 1·85c.; by sail, 1·82½c. for nearby and 1 80c. for shipment.

Double manure salts, basis of 48 per cent potash, are firm at 1 20@1·22½c. High grade sulphate of potash, basis 90 per cent, is sold at 2·40@2·45c. on the spot.

Kainit may be had in small quantities on the spot at $10.25@$10.50 per ton. For forward shipment, $9.75 is asked.

Brimstone is slightly firmer at $20.25 for best unmixed seconds, and $19.25 for thirds on the spot.

Nitrate of Soda —The entire supply on the spot is reported in the hands of those who are members of the combination, and the price should therefore be quoted at the regular figures, 2·37½@2·40c. Later, we hear of a few hundred bags on the spot offering at 2·35c.

Liverpool. Feb. 1.

[From our Special Correspondents.]

Chemicals.—Messrs. J. P. Brunner & Co. write us as follows: So far, the chemical trade shows no signs of improvement, but January is usually a dull month, and when the spring season opens a general improvement is looked for. The caustic soda makers held a meeting here yesterday, and the committee were invested, so it is reported, with unlimited powers as regards restricting production whenever considered necessary. After the general meeting the committee met and decided to order a reduction in make during February to the extent of 25 per cent. This is hardly likely to have much effect on the market, so long as the demand does not improve, but when the spring supplies are wanted it is expected the reduction in output will then begin to be felt, and prices stiffen in consequence. Soda ash is without any special feature, and fresh orders are not very plentiful. On the spot nearest values are: Caustic ash, 48 per cent, 3/32d. to 1 1/16d.; high test, 1d. to 1 1/16d.; carbonate ash, 48 per cent, 1d. to 1/16d.; high test, 1 1/32d. to 1 1/16d. Soda crystals are rather slow of sale, and £2 10s. is the nominal quotation, while a shade less might possibly buy in some quarters, for quantity. Caustic soda, in the early part of the week was very flat, and in order to clear January deliveries, re-sellers, in several cases, accepted £6 15s. for 70 per cent. These cheap parcels were readily picked up, and the figure has since been refused, there being now less pressure to sell. To-day quotations for prompt delivery range as follows: Sixty per cent, £5 16s. 3d. to £6; 70 per cent, £6 16s. 3d. to £7; 74 per cent, £7 7s. 6d. to £7 10s; 76 per cent, £8 10s. Makers decline to sell for forward delivery except at a considerable advance on spot prices. Bleaching powder is attracting little attention from buyers at the moment. Sellers ask £7 12s. 6d. for prompt delivery, but this has been shaded in some cases. Chlorate of potash weak at 5¼@5½d. Bicarbonate of soda steady at £4 12s. 6d. to £4 15s. per ton for one cwt. kegs, according to brand and quantity.

BUILDING MATERIAL MARKET.

NEW YORK, Friday Evening, Feb. 15.

The National Association of Builders has been in session for three days at Philadelphia this week The attendance was large and many interesting and instructive papers were presented. Among the New York delegates taking an active part in the discussions were Albert G. Bogert, Richard T. Auchmutz, Marc Eidlitz, Richard Deeves, and John J. Tucker, one of the Aqueduct Commissioners, who read a learned paper on "Masonry." Mr. James Sharkey, of Brooklyn, delivered a stirring speech on the present system of apprenticeship, and was appointed one of a committee of three to co-operate with a similar committee of the National Board of Trade to petition Congress to assist in the maintenance of trade schools. Mr. Samuel J. Cresswell, of Philadelphia, spoke on "Iron Work, Past and Present," giving a brief history of the use of structural iron.

Mr. Wm. H. Sayward presented the following figures, showing the number of exchanges connected with the building trades of America: Builders, 63; carpenters, 26; masons, 31; painters, 50; plumbers, 61; plasterers, 7; roofers, 4; iron workers, 4; sheet-metal workers, 2; stone workers, 13; brick-makers, 10; lumber and mill workers, 62; steam fitters, 1; trade schools, 3; real estate exchanges, 3; architects' associations, leagues, clubs, etc., 46; engineers' and surveyors' associations, 29; water-works associations, 2; total in the United States, 425; in Canada, 20; in both, 445.

Locally there is little of interest to report concerning building material matters. The number of new buildings projected in this city during January was 250, against 117 during the same period last year. The estimated cost of these projects is about $2,000,000 greater than in 1888. The real estate market also shows an improvement, a healthy, vigorous feeling being apparent on all sides. The situation is, therefore, a strong one and certainly justifies the hopeful opinions that have been generally expressed since the beginning of the year.

Bricks.—River navigation being completely closed, nothing further from this source may be expected for some time to come. Jerseys are also at a premium, arrivals being light. One cargo was sold this week, we understand, at $7.50 per thousand. Long Island stock is consequently the only available brick, and commands full prices.

Lime.—All arrivals are reported "all sold." Offerings continue very light, quite behind the seasonable demand, and sellers are generally conceded the advantage.

Roofing Slate continues to move at the advanced prices

IMPORTS AND EXPORTS OF METALS AT NEW YORK FEBRUARY 4th TO FEBRUARY 6th, 1889, AND FROM JANUARY 1st.

IMPORTS.

Spelter.	Week. Tons.	Year. Tons.
Amer. Metal Co		56
Total		56
Corres. date, 1888		98

Nickel.	Lbs.	Lbs.
McCoy & Sanders		11,240
Total		11,240

Antimony.	Casks.	Casks.
Total	50	300
Corres. date, 1888	34	388

Tin.	Tons.	Tons.
Amer. Metal Co	6	34
Bidwell & French		28
Crooks & Co		60
Daval & Son, John		11
Hendricks Bros		30
Lehmarer, S. & Co		11
Muller, Schall & Co		168
Naylor & Co		151
Phelps, Dodge & Co		380
Schmarer & Co		11
Thomsen, A. A		112
Thomsen, D		11
Wheeler & Co		1
Total	6	1,008
Corres. date, 1888	60	768

Tin Plates.	Boxes.	Boxes.
Bruce & Cook	3,214	9,608
Byrne & Co., J		2,883
Central Stamp. Co		10,338
Coddington & Co	7,492	26,117
Cort & Co., N. L	2,438	8,025
Corbier, F. & S		1,132
Crooks & Co	1,515	2,742
De Milt & Co	870	3,624
Dickerson, V. D	5,511	43,859
G. L. N		72
Iron Clad M. Co		45
Lalance & Grosjean		3,021
Lombard, Ayres		2,000
Merchant & Co		1,444
Mersick & Co		988
Morewood & Co		2,212
Phelps, Dodge & Co	18,772	67,202
Pratt Mfg. Co	2,742	33,346
Shepherd & Co	650	3,671
Somers Bros		569
Thomsen, A. A	3,869	32,101
Wheeler & Co		2,309
Whittemore & Co	1,726	2,770
Total	48,599	261,057
Corres. date, 1888	69,747	175,262

Pig Iron.	Tons.	Tons.
Bartlett, N. S		200
Crocker Bros	100	800
Crooks & Co		100
Martin, W. T		150
Naylor & Co	50	50
Page, Newall & Co		50
Pope, J. E., Jr		230
Stetson & Co		700
Williamson & Co	100	400
Total	250	2,650
Corres. date, 1888	1,500	5,467

Steel Sheets, Billets, Forging, etc.	Tons.	Tons.
Abbott & Co		481
Bowker, C. F		29
Carey & Moen		46
Carter, G. F		200
Crenshaw, Hugh		25
Crooks & Co	29	80
Cortis, R. J		80
Curran, J		5
Dana & Co	162	1,097
Downing & Co	16	44
Erie Despatch		40
Hugill, Chas	7	40
Ismay, J. B		53
Lalance, & G	11	63
Leng's Sons, J. S		2
Lundberg, G		50
Mersick & Co	5	5
Milne & Co	44	775
Naylor & Co	18	816
Newton & S		8
Oelrich & Co		91
Pierson & Co		103
Pilditch, F. S	4	11
Power, C. W		8
Prosser, Thos		80
Schulze & R		3
Temple & L		2
Wagner, W. F	15	78
Wallace & Co		5
Whitney & W		7
Wiell & Co		7
Williams & W		75
Wolff, R. H		44
Total	311	4,333
Corres. date, 1888	238	593

Bar Iron.	Tons.	Tons.
Abbott & Co., J		235
Bacon & Co		87
Downing & Co	30	230
Jacobus, E. G		8
Milne & Co		89
Total	30	649
Corres. date, 1888	187	1,347

Steel and Iron Rods.	Tons.	Tons.
Abbott & Co., J	30	332
Boker, H		3
Carey & Moen	28	123
Crabb & Co., W		5
Dana & Co		1,530
Downing & Co		125
Fuller, D. & T		15
Galpin, S. H	50	165
Heyn, A	100	256
Lilienberg, N		1
Lundberg, G		56
Lundell, C. G		50
Milne & Co		200
Muller, Schall & C		202
Naylor & Co		1,571
Page, N. & Co		99
Roebling's Son		301
Whitney & Co		70
Wolf & Co		449
Wright, P. & Co		3
Total	178	5,556
Corres. date, 1888	890	6,136

Old Rails.	Tons.	Tons.
Crossman & Bro		125
Neumark & Gross		568
Perkins, C. L		433
Ward & Co., J. E		21
Total		1,147
Corres. date, 1888	100	3,913

Scrap Iron.	Tons.	Tons.
Burgass & Co		162
Spaulding & Co		172
Ward & Co., J. E		20
Total		354
Corres. date, 1888	163	441

Sheet Iron.	Tons.	Tons.
Coddington & Co		64
Total		64
Corres. date, 1888	30	174

Charcoal Iron.	Tons.	Tons
Bacon & Co		97
Downing & Co		175
Milne & Co		88
Muller, S. & Co		25
Naylor & Co	20	20
Page, N. & Co		177
Total	20	583

Spiegeleisen.	Tons.	Tons.
Crocker Bros	100	1,339
Dana & Co	152	1,467
Farris & Co		325
Jansen, J. A	240	1,895
Naylor & Co	394	2,914
Perkins, C. L		101
Walbaum Bros		250
Total	886	8,591
Corres. date, 1888	2,125	2,776

Iron Ore.	Tons.	Tons.
Earnshaw, A		526
Total		526
Corres. date, 1888	350	1,039

EXPORTS.

Copper.	Pounds.	Pounds.
Abbott & Co		337,984
Amer. Metal Co		111,750
Hurst, F. W. J		113,000
Naylor & Co		299,524
Piper, D. & Co		3,898
Seaman, Sam'l H.	141,800	141,800
Total	141,800	1,007,956
Corres. date, 1888		8,709,921

Copper Matte.		
Abbott & Co		427,613
Amer. Metal Co	37,500	1,295,240
Henriott, F		4,317,130
Seaman, Sam'l H.	13,000	13,000
Wil'ms, Terhune		692,494
Total	50,500	6,745,474
Corres. date, 1888		9,945,342

CURRENT PRICES.

CHEMICALS.

Acid—Acetic, ℔ 100 lbs..... 2.00@2.25
Muriatic, 18°, ℔ 100 lbs ... 1.15@1.20
Muriatic, 20°, ℔ 100 lbs..... 1.35@1.50
Nitric, 36°, ℔ 100 lbs..... 4.00@5.50
Nitric, 42°, ℔ 100 lbs..... 5.50@7.00
Oxalic, ℔ 100 lbs..... 9.50@10.50
Sulphuric, 60°, ℔ 100 lbs..... 90@95
Sulphuric, 66°, ℔ 100 lbs..... 95@1.25
Alkali—36 p. c..... 1.12½@1.25
48 p. c..... 1.22½@1.25
Refined, 58°..... 1.15@1.25
Alum—Lump, ℔ lb..... 1¾
Ground, ℔ lb..... 1¾@2
Lump, ℔ ton, Liverpool ... £4 17 6
Sulphate of Alumina, ℔ ton..... £4 10
Aqua Ammonia—18°, ℔ lb..... 4¾
20°, ℔ lb..... 6
22°, ℔ lb..... 6@7
26°, ℔ lb..... 10@11
Ammonia—Sul., ℔ 100 lbs... 3.35@3.45
Carb., per lb..... 7½@8
Muriate per lb..... 6½@8
Arsenic—White, powdered, ℔ lb...3@3½
Red, ℔ lb..... 7
White, at Plymouth, ℔ ton. .. £11 10
Asbestos—Am., p. ton.....$50@$300
Italian, p. ton, c. i. f. L'pool.....£18
Asphaltum—P. ton 13.00
Prime Cuban, ℔ lb .. .. 4½@5½c.
Hard, ℔ ton..... $28.00
Trinidad, refined, ℔ ton..... $30.00
Barytes—Sulph., Am. prime white17.00
Sulph., foreign, floated, p. ton....20.00
Sulph., off color, p. ton 13.00
Carb., lump, f.o.b. L'pool, ton....£6 5 0
No. 1, casks, Runcorn " "£4 10 0
No 2, bags, Runcorn " " 3 15 0
Bleach—Over 35 p.c., ℔ lb...1.80@1.85
Borax—℔ lb 9¼
Refined at Liverpool, ℔ ton..... £29
Brimstone—*See Sulphur.*
Bromine—℔ lb..... ....37@38
Chalk—℔ ton..... ..... 3.15
Precipitated, ℔ lb. 5
China Clay—English, ℔ ton13.50@18.50
Southern, ℔ ton..... 13.50
Chrome Yellow—℔ lb..... .... 10@25
Cobalt—Oxide, ℔ lb..... ..2·60@2·90
Copper—Sulph. English Wks.,ton.....£25
Precip., Eng. Wks, unit... fluctuating
Copperas—Common, ℔ 100 lbs.52@57½
Best, ℔ 100 lbs..... ....75@1.00
Liverpool, ℔ ton, in casks .....£1 15s.
Cream of Tartar—Am. 99%....24@24¾
Powdered, 99 p. c..... 24¾@25½
Emery—Grain, ℔ lb 4
Flour, ℔ lb 2½
Feldspar—Ground, ℔ ton..... ....16.00
Fuller's Earth—Lump, ℔ bbl. .90@95
Powdered, ℔ lb.. ....1⅞@2
Gypsum—Calcined, ℔ bbl. 1.25
Iodine—Resublimed..... 3.50
Kainit—℔ ton..... .... 9.75@10.50
Kaolin—*See China Clay.*
Lead—Red, ℔ lb. .... 6¾@7
White, American, in oil, ℔ lb... 7@ 7¼
White, English, ℔ lb ....8½@9
Acetate, or sugar of..... 12@13
Lime Acetate—Amer. Brown.1.00@1.05
" Gray1.87½@1.90
Litharge—Powdered, ℔ lb. .. .6½@6¾
English flake, ℔ lb..... 6@6½
Magnesite—Greek, ℔ ton.. ...10.00
Manganese—lump, c. i.f. L'pool 62s. 6d.
Per unit, up or down..... ..... 1s. 6d.
Ground..... £5 17
Mercuric Chloride—(*Corrosive Sublimate*) ℔ lb. ..... 65@67
Mineral Wool—℔ lb..... 2
Mica—In sheets according to size,
1st quality, ℔ lb..... 25@$6 00
Phosphate Rock—S. Carolina,
per ton f. o. b. Charleston. 5.00@6.00
Ground, ex vessel New York.10.00@10.50
Canadian Apatite, lump, f. o. b. at
shipping port, ℔ unit..... .. —
Phosphorus—℔ lb..... .... 70@75
Plumbago—Ceylon, ℔ lb. ... . 4@5
American, ℔ lb..... 5@7
Potassium—Cyanide, ℔ lb.... .39@40
Bromide, ℔ lb..... 33
Chlorate, ℔ lb. ....14½@15½
Carb. ℔ lb..... ....4.70@5.50
Caustic, ℔ lb..... 7½@8
Iodide..... ....2.70@2.75
Muriate, ℔ 100 lbs..... ....1.80@1.85
Nitrate, refined, ℔ lb..... 6
Bichromate, ℔ lb ..... 11½@12
Sulphate, ℔ 100 lbs..... .. 2 40
Yellow Prussiate, ℔ lb..... 18
Red Prussiate, ℔ lb..... .... 45@45
Pumice Stone—Select lumps, lb. 3¼
Original cks., ℔ lb..... . ..... 1¾
Powdered, pure, ℔ lb.. . ..... 2¼@2½
Pyrites—Non-cupreous, p. unit, s. 5d.
Quartz—Ground, ℔ ton. 16.00
Rotten Stone—Powdered, ℔ lb..3¼@3½
Lump, ℔ lb..... ..... 6@10
Eng., powdered, ℔ ton. £4
Lump, ℔ ton..... £5
Salt—Liverpool, ground ℔ bbl. . 75@80
Turk's Island, ℔ bbl..... ..30@33
Salt Cake—℔ 100 lbs. .....50@57
Saltpeter—Crude, ℔ lb. ... .. 5@5½
Refined, ℔ lb. .... 6@8
Soda Ash—Carb.,48 ⅌ 100 ℔... 1.25
High test..... ... 1.12½@1.15
Caustic, 48 ⅌..... 1.25
Soda Caustic, 60⅌.....2 40@2.65
" " 70⅌..... 2.25
" " 74–5⅌..... 2.25
Sal, English, ℔ 100 lbs.... .85 @ .90
Sal, American, ℔ 100 lbs ... .80 @ .85
Nitrate, ℔ 100 lbs..... 2.32½@2.40
Strontium—Nitrate ℔ lb. ..... 9@9½
Sulphur—Roll, ℔ lb..... .... 4¾
Flour, ℔ lb..... 2
Crude Brimstone, 2s., ℔ ton.20.00@21.00
Crude Brimstone, 3ds, ℔ ton.19.00@.....
Talc—Ground French, ℔ lb .. ...1¼@1½
Domestic, ℔ lb..... ¼
Domestic, ℔ ton..... 15 00
c. i. f. Liverpool, ℔ ton..... .. £4 5 0
Tannin—Pure, ℔ lb. . .....
Vermillion—American, ℔ lb... . 61
English, ℔ lb.. ..... 82@85
Vitriol—(Blue), Ordinary, ℔ lb..5¾@6½
Extra, ℔ lb..... 6½@6¾
Zinc Oxide—Am., Dry, ℔ lb. 4½
Antwerp, Red Seal, ℔ lb..... .....6@6½
Paris, Red Seal, ℔ lb. ....6½@7
* Spot

BUILDING MATERIAL.

Bricks—Pale, ℔ 1,000 ..... 3.50@4.00
Jerseys, ℔ 1,000.. ..... 6.50@7.50
Hackensacks, ℔ 1000..... .....
Up Rivers, ℔ 1000..... .... 7.50@7.75
Haverstraw seconds, ℔ 1000.. 7.75@8.00
Haverstraw firsts ℔ 1,000. .. 8.00@8.75
Fronts, nominal, ℔ 1000.
Croton..... ..... 14.00@16.00
Wilmington. ..... 20.00@21.00
Philadelphia..... ... ... 28.00@29.00
Trenton..... . @28.00
Baltimore..... 37.00@41.00
Building Stone—Amherst
freestone, ℔ cu. ft... ..... 95@1.00
Brownstone, ℔ cu. ft. ..... 1.00@1.35
Granite, rough, ℔ cu.ft..... . 45@1.25
Granite, Scotch ℔ cu. ft.. .. 1.00@1.15
Cement—Rosendale, ℔ bbl 1.15@1.20
Portland, American, ℔ bbl.. 2 15@2.45
Portland, foreign, ℔ bbl.. .. 2.10@2.40
Portland, " special brands.. 2.45@3.75
Roman, ℔ bbl. .... 2.65@2.85
Keene's coarse, ℔ bbl..... .... 4.50@6.50
Keene's fine, ℔ bbl..... .. . 7.00@9.25
Slate—Purple and green roofing, ℔ 100 ft..... ..... 5.00@6.00
Red roofing, ℔ 100 sq. ft... .15.00
Black, roofing, ℔ 100 sq. ft... 4.50@5.25
Lime—Rockland, common ℔ bbl... .1.00
Rockland, finishing, ℔ bbl..... 1.20
St. John, com. and finish, ℔ bbl. .90
Glens Falls, com. and fin., ℔ bbl .80@1.10
Labor—Ordinary, ℔ day..... 1.50@2.00
Masons, ℔ day..... ..... 4.00
Plasterers, ℔ day..... ..... 4.00
Carpenters, ℔ day..... ..... 3.50
Plumbers, ℔ day..... ..... 3.50
Painters, ℔ day..... ..... 2.50@3.50
Stonesetters, ℔ day..... .3.50@4.00
Tilelayers, ℔ day..... 3.50@4.50
Bricklayers, ℔ day..... ..... 4 00

THE RARER METALS.

Aluminum—(Metallic), per lb...$8.50
Arsenic—Metallic, per lb..... 20
Barium—(Metallic), per lb..... 975.00
Bismuth—(Metallic), per lb..... 2.40
Cadmium—(Metallic), per lb..... 1.25
Calcium—(Metallic), per oz..... 150.00
Cerium—(Metallic), per oz..... 160.00
Chromium—(Metallic), per lb...200.00
Cobalt—(Metallic), per lb..... 6.00
Didymium—(Metallic), per oz...160.00
Erbium—(Metallic), per oz.... ...140.00
Gallium—(Metallic), per oz 3250.00
Glucinum—(Metallic) per oz ...250.00
Indium—(Metallic), per oz..... 158.00
Iridium—(Metallic), per lb..... 650.00
Lanthanum—(Metallic), per oz.175.00
Lithium—(Metallic), per oz..... 160.00
Magnesium—Per lb.... ..... 4.50
Manganese—Metallic, per lb.... 1.10
Molybdenum—(Metallic), per oz. 6.00
Niobium—(Metallic), per oz..... 128.00
Osmium—(Metallic), per lb 640.00
Palladium—(Metallic), per lb...400.00
Platinum—(Metallic), per lb. ..130.00
Potassium—Metallic, per lb.... 32.00
Rhodium—(Metallic), per lb....512.00
Ruthenium—(Metallic), per oz..112.00
Rubidium—(Metallic), per oz....200.00
Selenium—(Metallic), per oz.... 3.00
Sodium—(Metallic) per lb. .. 3.00
Strontium—(Metallic), per oz...128.00
Tantallum—(Metallic) per oz....144.00
Telurium—(Metallic) per oz.... 9.00
Thallium—(Metallic) per oz..... 3.00
Titanium—(Metallic) per oz....32.00
Thorium—(Metallic) per oz.....272.00
Tungsten—(Metallic) per lb..... 1.25
Vanadium—(Metallic), per oz..320.00
Ytrium—(Metallic), per oz 144.00
Zirconium—(Metallic), per oz..240.00

METALS.

Aluminum—
Bronze (10 ⅌), ℔ lb..... 46c.
Copper—
Lake Ingot, Spot, ℔ lb..... .... 16·75c.
Electrolytic, ℔ lb. .. .. 16c.
Casting Brands, ℔ lb. .... 15¾c.
Chili Bars, London, ℔ ton .... £77 10s.
Sheet Copper (according to size), ℔ lb..... .....25 @38c.
G. M. B..... £77 10s.
Nickel.—
Metallic, per lb..... 61c.
Lead—
Domestic, Common, Spot... 3·70c.
Foreign..... .... 4·75c.
Sheet, ℔ lb, net..... .. 7c.
Pipe, ℔ lb ..... 6½c.
Tin lined Pipe, ℔ lb..... 15c.
Shot, ℔ 25-lb. bag..... 1·45c.
Spanish Lead, London... .. £12 15s.
Tin—
Tin Plates..... .. .. 13s. 6d.
Tin Spot in London £95
Pig tin, spot in N. Y., ℔ lb.. 21·45c.
Zinc—
Domestic spelter, ℔ lb..... .. 4·90c.
Foreign spelter, ℔ lb... ... 5·55c.
Silesian, ton..... ....£17 17s 6d.
Sheet, American, ℔ lb... .... 6¾c.
Antimony—Hallet's, per lb.... 11¾c.
Cookson's, per lb..... ..... 13c.
Star Antimony..... .... £46
Quicksilver—Per lb..... .. 56@58c.
London, ℔ flask..... ..... £8 10s.

IRON AND STEEL.

New York Prices.

American Pig-Iron.—At tidewater.
No. 1 X..... .....$17.00@$18.00
No. 2 X..... . .... 16.00@ 17.00
Forge ..... 15.50@ 16.00
Scotch Pig—Coltness... $20.50@.....
Clyde ..... 19.75@$20.00
Dalmellington..... 19.25@ 19.50
Summerlee..... .....
Shotts..... 20.00@ 20.50
Langloan ..... 20.00@ .....
By Cable to-day to the Metal Exchange:
Scotch Warrants..... 41s. 4d.
Coltness, at Glasgow..... .51s.
Langloan, at Glasgow..... .50s.
Summerlee, at Glasgow..... 50s. 3d.
Gartsherrie, at Glasgow..... 48s. 6d.
Glengarnock, at Ardrossan..... 48s.
Dalmellington, at Ardrossan..... 44s.
Eglinton, at Ardrossan ... .42s. 6d.
Bessemer Pig—
Foreign, nominally..... .....
Domestic " ..... 15 50@ 16.50
Spiegeleisen—
German, 20 per cent..... .....
English, 20 " " ..... 27.50@ 28.00
" 30 " " ..... 33 00@ 34.00
Ferro Manganese, 80%..... 55.00
Steel Blooms, nominally ....
Steel Billets, " 30.00@ 33.00
Steel Nail Slabs, " 28.00@ 28.50
Steel Wire Rods, " 41.00@ 41.25
Steel Rails—
Heavy sections, at mill.... 28.00@ 28.00
Light " " ..... 30.00@ 32.00
Structural Iron and Steel—
Bridge Plate, at mill.. .....2·00@2·1c.
Angles, at mill ..... 1·90@2·00c.
Tees, at mill..... .. ..2 40@2·60c.
Steel Angles, at mill.... ....2¼ @2½c.
Beams and Channels, on wharf, 2·8c. base.
Steel Plates—
Tank and Ship, on wharf..... 2¾@2¼
Shell, on wharf..... .... 2¾@3
Flange, " ..... 3 @3¼
Fire-Box, on wharf..... 3¼@4
Iron Plates—
Common tank, on wharf....2·0@2·2c.
Refined, on wharf.....2·3@2·4c.
Shell, " ..... 2¼@2 4c.
Flange. " ..... 3·4@3·5c.
Extra flange..... 3¾@4
Bar Iron—
Refined..... ..... 1·8@2·0c.
Common ..... 1·65@1·75c.
Merchant Steel—
American tool .... 8½@10c.
Special grades..... 13 @20c.
Crucible machinery..... 5 @6c
" spring..... ... 4½c.
Bessemer machinery..... 2·0@2·5c.
" spring. ..... 2·7@2·9c.
Cast-Iron Pipe—At works:
According to size..... $25 00@$31.00
Wrought-Iron Pipe—nominal—
Butt-Welded, Plain and Tarred, 55⅌ disc; Galv., 45⅌ disc.
Lap-Welded, Plain and Tarred, 65⅌ disc.; Galv., 55⅌ disc.
Boiler Tubes—Per cent disc.....62½⅌
Rail Fastenings—
Spikes..... .... 2·1@2·15c. delv'd
Angle Fish-bars..... .1 85@2c.
Bolts and Sq Nuts.....2·9 @3c.
" Hex. " .....3·1 @
Wrought Scrap—
Foreign, *ex store*..... @
No. 1 Yard *to vessel*..... 20.50@ 21.50
Cast Scrap .... 15.50@ 16.50
Old Car Wheels..... ... 17.00@ 18.00
Old Rails—Tees .... 23.00@ 23.50
—Doubles ....@ 25 00
Nails—In car-load lots. .. $1.80@ $2.00
—From store ..... 1.85@ 2.00
Nails .... $1.90 usual discount
Steel Nails..... ....$1.90
Wire Nails..... ..... 2.55
Two per cent off for cash. * At works.

Louisville Prices.

Hot Blast Irons—
So. Coke, No. 1..... ....$14.75@$15.25
" " No. 2..... 14 00@ 14.50
" " No. 3..... 13 00@ 13.50
Mahening Valley (Lake Ore Mixture) .... 18.00@ 19.00
So. Charcoal, No. 1..... 17.00@ 17.50
" No. 2..... 16.00@ 16.50
Missouri Charcoal No. 1.... 18.00@ 18.50
" " No. 2.... 17.75@ 18.00
Forge Irons—
Neutral Coke..... $13.00@$13.50
Cold Short ..... 12.75@ 13.25
Mottled..... 12.00@ 12.25
Car Wheel and Malleable Irons—
Southern (standard brands).$21.50@$22.00
" (other brands)..... 17.50@ 18.50
Lake Superior..... 22.00@ 22.00

Pittsburg Prices.

Coke or Bituminous Pig—
Foundry No. 1..... ....$16.75@17.00
Foundry No. 2..... .... 16.00@16.25
Gray Forge No. 3..... 14.50@14.75
" " No. 4.... ... . 14.25@.....
White .... 14.25@.....
Mottled..... ..... 14.25@.....
Silvery..... ..... 16.50@18.50
Bessemer..... 16.50@16.75
Low Phos..... ..... 21.00@.....
Charcoal Pig—
Foundry No. 1. ..... 23.50@24.50
Foundry No. 2..... . 22.00@23.50
Cold-Blast..... 25.00@28.00
Warm-Blast..... 24.00@25.00
20 p. c. Spiegel..... 27.50@28.00
Muck-Bar..... .... 27.50@.....
Steel Blooms..... .... 28.00@.....
Steel Slabs..... ..... 27.50@.....
Steel Crop Ends..... ..... 19.00@19.25
Steel Bloom Ends..... ..... 18.00@18.50
Ferro Manganese, 80%.. . ... 56.00@57.00
Steel Billets..... ..... 27.50@28.00
Old Iron Rails..... ..... 23.50@23.75
Old Steel Rails..... ..... 18.50@19.50
No. 1 W. Scrap..... ..... 21.00@.....
No. 2 W. Scrap.. . ... 18.50@19.00
Steel Rails..... .... 28.00@.....
" light sections..... 28.00@21.00
Bar Iron, nominal..... 1.75@ 1.80
Iron Nails..... 1.95
Steel Nails..... 1.95
Wire Nails..... 2.25

Philadelphia Prices.

Foundry No. 1..... $17.50@18.00
Foundry No. 2..... 16.50@17.00
Gray Forge..... 15.50@15.25
Bessemer Pig..... 20.00@.....
Steel Rail Blooms..... 29.50 nom
Foreign Bessemer..... 20.00@.....
Spiegeleisen. ....@28.00
Scrap, Selected..... 22.00@22.50
No. 1..... ... . 21.00@22.00
Cargo Scrap..... ... ... 20.00@21.00
Muck-Bars..... ....@27.50
Merchant Iron..... . .... 1.70@ 1.90
Plate Iron..... .... 1.90@ 2.00
Tank Iron ..... 2.00@ 2.10
Skelp Iron..... ..... 1.75@ 1.80
Angles..... ..... 2.00@.....
Beams and Channels..... .. 2.80@.....
Nails..... ... . 1.70@ 1.90
Steel Rails. ..... 27.00@28.00
Old Rails..... 23.50@24.00

STOCK MARKET QUOTATIONS

Baltimore, Md.

COMPANY.	Bid.	Asked.
Atlantic Coal....	1.25	....
Balt. & N. C.....	.20	....
Big Vein Coal...	1.10@1.15	....
Conrad Hill ...	.05	.15
Diamond Tunnel	.35@.38	.45@.50
George's Crk.C.	105@107	115
Lake Chrome..	.05	.07@.10
North State(Balto.)	.20	....
Silver Valley....	.40	.50@.60

Highest and lowest prices bid and asked during the week ending February 14th.

Birmingham, Ala.

COMPANY.	Bid.	Asked.
Ala. Conn. C..	....	$27
Ala. R. Mill Co.	....	$6C@$100
*Alice Furnace.	$101	....
Bess. Land Co.	$20@$21¼	$20⅞@$22½
Bir. Fur. & Mg.	....	$20
Broken Arrow.	....	$15½
Decat. L. Imp.	$12@$12½	$13⅞@$13¼
DecaturMin.L.	$22	$23@$28
Enterprise Mfg.	....	$50
*Eureka	$98½@$101	$107@$109
Hen. S. & M.Co.	$90@$125	$100@$129
Jagger-Townley	$4	$5⅜
Mag-Ellen.....	$90@$95	....
*Mary Pratt..	....	$102
†Sloss I. & S....	....	$56
Tenn.C. & I. Co.	$34	$36
*Williamson...	$99¾	....
Woodstock I. Co.	$55@$56	$56½@$57¼

Sales during the week ended Feb. 9th.

Bessemer Land Co.....	30 shs.	$21@$22
Henderson S. & M. C....	134 shs.	$91@$115

* Bonds. †† First mortgage. † Second mortgage.

Pittsburg, Pa.

COMPANY.	H.	L.	Closing.
Bridgewater Gas.	50.00	50.00	50.00
Charlotte Mining..	5.00	5.00	5.00
Chartiers Val. Gas.	56.00	56.00	56.00
Columbia Oil..	3.88	3.88	3.88
Hazlewood Oil.....	41.00	41.00	41.00
La Noria Mining ..	1.88	1.63	1.75
Pennsylvania Gas .	134.00	134.00	134.00
Philadelphia Co...	38.88	37.25	37.38
Pittsburg Gas ...	61.50	61.25	61.25
Silverton Mining..	1.50	1.50	1.50
Tuna Oil Co.....	66.25	66.25	66.25
W'house A. B. Co..	121.00	119.50	121.00
W'house B. Co. Lm.	63.00	61.00	62.50
Wheeling Gas ...	29.13	28.50	29.00

Highest and lowest prices bid and asked during the week ending February 12th.

Foreign Quotations.

London. February 2.

COMPANY.	Highest.	Lowest
Alturas Gold, Idaho...	4s.	3s.
Arizona Copper, Ariz..	18s. 6d.	18s.
Birdseye Creek.....	4s. 6d.	3s. 6d.
Callao Bis., Venz.....	11s. 6d.	10s. 6d.
Carlisle, N. Mex	8s.	7s.
Colorado United, Colo...	5s.	2s. 6d.
Columbian, S. A.....	£2	£1¾
Comstock, Utah.....	£1¼	£1⅛
Cons. Esmeralda, Nev..	7s.	6s.
Denver Gold, Colo.....	2s.	1s. 6d.
Dickens Custer, Idaho.	3s.	2s.
Eberhardt, Nev	2s.	1s.
El Callao, Venezuela....	£3⅛	£2⅜
Empire, Mont	9s. 6d.	8s. 6d.
Flagstaff, Utah.....	4s.	3s.
Garfield, Nev..	15s.	12s. 6d.
Gold Hill, N. C.....	1s. 9d.	1s. 3d.
Ilex, Cal.....	£⅜	£⅛
Josephine, Cal.....	6s.	4s.
Kohinoor, Colo.....	3s.	2s.
Mason & Barry, Port....	£9⅛	£9
Montana Lt., Mont	£2 5-16	£2 1-16
New California, Colo....	9s.	8s.
New Consolidated.....	2s.	1s. 6d.
New Emma, S., Utah...	5s. 6d.	4s. 6d.
New Hoover Hill.....	3s.	2s. 6d.
New La Plata, Colo..	2s. 6d.	1s. 6d.
North Mexican, Mex....	7s. 6d.	5s. 6d.
Old Lout, Colo.....	£1⅜	£1⅛
Pittsburg Cons., Nev...	20s. 6d.	20s.
Quebrada, Venezuela,..	£5⅜	£5⅞
Richmond Con., Nev...	£2⅛	£2¼
Ruby&Dunderberg, Nev	2s. 6d.	2s.
Russell Gold, N. C.....	3s. 6d.	2s. 6d.
Sierra Buttes, Cal.....	15s.	12s. 6d.
United Mexican, Mex...	£3¾	£3⅛
U. S. Placer, Colo.....	6s. 6d.	5s. 6d.
Viola Lt., Idaho	7s. 6d.	6s. 6d.

*Paris.** January 31.

Belmez, Spain.....540.00		540.00
El Callao, Venezuela..	58.00	58.00
Golden River, Cal 410.00		410.00
" " parts..	80.00	80.00
Lexington, Mont. ...120.00		120.00
" parts.....	4.75	4.75
Rio Tinto, Spain.....	517.50	517.50
Tharsis, Spain.. ...	135.00	135.00

* Francs.

DIVIDEND-PAYING MINES.

	Name and Location of Company.	Capital Stock.	Shares. No.	Shares. Par	Assessments. Total levied.	Assessments. Date and amount of last.			Dividends. Total paid.	Dividends. Date and amount of last.		
1	Adams, S. L.	Colo.	$1,500,000	150,000	$10	*	....	....	$555,000	Jan.	1887	.15
2	Alice, S. C.	Mont	10,000,000	400,000	25	*	....	....	775,000	Dec.	1888	.06½
3	Alma Cons., G.	Idah.	300,000	30,000	10	*	....	....	45,000	Dec.	1888	.50
4	Alturas, G.	Idah.	1,500,000	300,000	5	.....	....	.....	262,500	Jan.	1888	37½
5	Amy & Silversmith, S.	Mon.	.....	341,419	.....	.....	....	.....	247,530	Aug.	1887	12½
6	Atlantic, C.	Mich	1,000,000	40,000	25	$280,000	Apl.	1875	$1.00	520,000	Feb.	1889	2.00
7	Argenta, S.	Nev.,	10,000,000	100,000	100	325,000	July	1885	.10	40,000	Feb.	1880	.20
8	Aspen Mg. & S., S. L.	Colo.	2,000,000	200,000	10	*	....	....	....	160,000	Feb.	1889	.20
9	Aurora, L.	Mich	2,000,000	100,000	20	*	....	....	....	155,000	Oct.	1887	1.37½
10	Bassick, G. S.	Colo.	10,000,000	100,000	100	*	....	....	....	400,000	Mar.	1884	1.00
11	Belle Isle, S.	Nev.,	10,000,000	100,000	100	145,000	Feb	1887	.20	300,000	Dec.	1888	.25
12	Belcher, G. S.	Nev.,	10,400,000	104,000	100	2,770,000	Sept	1888	.50	15,397,200	Apl	1876	1.00
13	Bellevue Idaho, S. L.	Idah.	1,250,000	125,000	10	76,250	Nov.	1888	.15	187,500	Jan.	1887	.10
14	Bodie Con., G. S.	Cal.,	10,000,000	100,000	100	500,000	Sept	1888	.50	1,295,000	Apl.	1885	.50
15	Bonanza Develoum't	C & H.	3,000,000	150,000	20	*	....	....	....	135,000	Feb.	1882	.15
16	Boston & Mont., G.	Mon.	2,500,000	250,000	10	*	....	....	....	520,000	Jun.	1888	.10
17	Boston & Mont., C.S.	Mon	2,500,000	100,000	25	*	....	....	....	400,000	Nov.	1888	2.00
18	Breece, S.	Colo	5,000,000	200,000	25	*	....	....	....	2,000	Feb.	1880	.01
19	Brooklyn Lead, L. S.	Utah	500,000	50,000	10	*	....	....	....	127,000	July	1887	.05
20	Bulwer, G.	Cal.	10,000,000	100,000	10	80,000	May	1888	.20	175 000	Jan.	1884	.10
21	Bunker Hill & Sull.	Idah.	3,000,000	300,000	10	*	....	....	....	150,000	Oct.	1883	.06⅔
22	Caledonia, G.	Dak.	10,000,000	100,000	100	505,000	May	1885	.15	72,000	Feb.	1880	.08
23	Calumet & Hecla, C.	Mich	2,500,000	100,000	25	1,200,000	....	....	.....	31,850,000	Feb	1889	5.00
24	Carbonate Hill S. L.	Colo.	1,500,000	300,000	10	*	....	....	.....	80,000	Apl.	1884	.05
25	Carlisle, G.	N. M.	1,000,000	200,000	5	*	....	....	.....	175,000	Dec.	1888	.12½
26	Castle Creek, G.	Idah.	1,000,000	100,000	1	*	....	....	.....	51,000	Oct.	1883	.03
27	Catalpa, S. L.	Colo.	3,000,000	300,000	10	*	....	....	.....	270,000	May	1884	.10
28	Central, C.	Mich	500,000	20,000	25	100,000	Sept	1861	.06	1,937,000	Feb.	1889	2.00
29	Chrysolite, S.	Colo.	10,000,000	200,000	50	*	....	....	.....	1,650,000	Feb.	1884	.25
30	Colorado Central, S. L.	Colo.	2,750,000	275,000	10	*	....	....	.....	381,750	Feb.	1889	.05
31	Confidence, S. L.	Nev.,	.....	24,980	....	287,440	Apl.	1887	.50	174,720	Aug.	1888	1.00
32	Cons. Cal. & Va., G. S.	Nev.	21 600 000	216,000	100	108,000	Jan.	1885	.20	2,656,800	Feb.	1889	.50
33	Contention, S.	Ariz.	12,500,000	250,000	50	*	....	....	.....	2,587,000	Dec.	1884	.25
34	‖Cop. Queen Cons., C.	Ariz.	1,440 000	140,000	10	*	....	....	.....	140,000	Oct.	1888	.50
35	Crescent, S. L. G.	Utah	15,000,000	300,000	50	*	....	....	.....	228,000	Oct.	1888	.03
36	Crown Point, G. S.	Nev.	10,000,000	100,000	100	2,825,000	Oct.	1888	.50	11,588,000	Jan.	1875	2.00
37	Daly, S. L.	Utah	3,000,000	150,000	20	*	....	....	.....	900,000	Jan.	1889	.25
38	Deer Creek, S. G.	Idah.	1 000,000	200,000	5	*	....	....	.....	10,000	Oct.	1888	.05
39	Deadwood-Terra, G.	Dak.	5,000,000	200,000	25	*	....	....	.....	11,000,000	Nov.	1887	.10
40	Derbec B. Grav., G. S.	Cal.,	10,000,000	100,000	100	90,000	Dec.	1881	.10	180.000	May	1887	.10
41	Dunkin, S. L.	Colo.	5,000,000	200 000	25	*	....	....	.....	360,000	Jan.	1889	.05
42	Dunstone, G. S. L.	Mont	1,000,000	200,000	5	*	....	....	.....	6,000	Nov.	1888	.03
43	Eclipse	Mont.	100,000	100,000	1	*	....	....	.....	20,000	Nov.	1887	.10
44	Elkhorn, S.	Mont	1,000,000	100,000	10	50,000	July	1883	.50	170,000	July	1887	.05
45	Empire Lt., G.	Mont	500,000	100,000	5	*	....	....	.....	70,500	Oct.	1887	.37½
46	Eureka Con., G. S. L.	Nev.,	5,000,000	50,000	100	500,000	July	1888	1.00	4,955,000	July	1888	.25
47	Evening Star, S. L.	Colo.	500,000	30,000	10	*	....	....	.....	1,412,500	Nov.	1888	.25
48	Excelsior, G.	Cal.,	10,000,000	100,000	100	560,000	Sept	1885	1.00	875,000	Oct.	1880	.25
49	Father de Smet, G.	Dak.,	10,000,000	100,000	100	200,000	Nov	1878	1.00	1,125,000	Dec.	1885	.20
50	Franklin, C.	Mich	1,000,000	40,000	25	220,000	Jun.	1871	.....	800,000	Dec.	1888	2.00
51	Freeland, G. S. C.	Colo.	5,000,000	200,000	25	*	....	....	.....	190,000	July	1886	.10
52	Fresno Enterprise, G.	Cal.,	5,000,000	100,000	50	.....	Mch	1883	.10	110,000	July	1882	.10
53	Garfield Lt., G. S.	Nev.	500,000	100,000	5	*	....	....	.....	85,000	Apl.	1888	.12½
54	Golconda, G. S.	Idah.	1,000,000	100,000	10	*	....	....	.....	120,000	May	1888	.60
55	Gould & Curry, G. S.	Nev.,	10,800,000	108,000	100	4,369,850	Jun.	1889	.30	3,826,800	Oct.	1870	10.00
56	Grand Central, S.	Ariz.	1,000,000	100,000	10	*	....	....	.....	625,000	Dec.	1882	.25
57	Grand Prize, S.	Colo.	10,000,000	100,000	100	595,000	Oct.	1888	.25	495,000	Mar.	1884	.25
58	Granite, S. L.	Idah.	500,000	500,000	1	*	....	....	.....	10,000	Jun.	1888	.02
59	Granite Mountain, S.	Mont	10,000,000	400,000	25	*	....	....	.....	5,300,000	Feb.	1889	.25
60	Green Mountain, G.	Cal.,	1,250,000	125,000	10	*	....	....	.....	212,000	Nov.	1881	.07½
61	Hale & Norcross, G. S.	Nev.,	11,200,000	112,000	100	5,086,000	July	1887	.50	1,822,000	Aug.	1888	.50
62	Hecla Con., S. G. L. C.	Mont	1,500,000	30,000	50	.....	....	....	.....	1,272,500	Jan.	1889	.50
63	Helena Mg & Red, G. S.	Mont	3,315,000	663,000	5	*	....	....	.....	197,970	July	1886	.06
64	Holmes, S.	Nev.,	10,000,000	100,000	100	300,000	Sept	1885	.10	75,000	Apl	1886	.25
65	Holyoke, G.	Idah.	200,000	200,000	1	.....	....	....	.....	27 000	Feb.	1883	.10
66	Homestake, G.	Dak.	12,500,000	125,000	100	200,000	July	1878	1.00	4,318,750	Jan.	1889	.20
67	Honorine, S. L.	Utah	500,000	250,000	2	25,000	Jun.	1883	.....	125.000	Sept	1887	.05
68	Hope, S.	Mont	1,000,000	100,000	10	*	....	....	.....	233,252	Apl.	1883	.25
69	Horn-Silver, S. L.	Utah	10,000,000	400,000	25	*	....	....	.....	4,000,000	Nov.	1884	.50
70	Hubert, G.	Colo.	500,000	50,000	10	*	....	....	.....	239,500	Oct.	1888	.11
71	Idaho, G.	Cal.,	310,000	3,100	100	*	....	....	.....	5,030,900	Jan.	1889	7.50
72	Ideal, S. L.	Colo.	1,500,000	50,000	10	*	....	....	.....	15,000	Oct.	1886	.05
73	Illinois, S.	N. M.	100,000	100,000	1	*	....	....	.....	25,000	Jan.	1887	.25
74	Independence, S.	Nev.,	10,000,000	100,000	100	340,000	Oct.	1886	.20	225,000	Sept	1879	.25
75	Indian Queen, S.	Nev.,	250,000	125,000	2	*	....	....	.....	368,750	July	1883	.03
76	Iron Hill, S.	Dak.	2,500,000	250,000	10	126,500	Jan.	1889	.03	156,250	Nov	1887	.07½
77	Iron-Silver, S. L.	Colo.	10,000,000	500,000	20	*	....	....	.....	2,400,000	Dec.	1888	.20
78	Jackson, G. S.	Nev.	5,000,000	50,000	100	237,500	Nov	1880	.20	50,000	Oct.	1886	.10
79	Jay Gould	Mont	2,000,000	400,000	5	*	....	....	.....	321,000	Dec	1888	.02½
80	Jocuistita, S.	Mex.	2,500,000	250,000	10	*	....	....	.....	1,200,000	Feb.	1885	.50
81	Jumbo, G.	Colo.	2,000,000	200,000	10	*	....	....	.....	35.000	Oct.	1887	.02½
82	Kentuck	Nev.,	3,000,000	30,000	100	342,000	Nov	1881	.30	1,350,000	Dec.	1886	.10
83	La Plata, G. L.	Colo.	2,000,000	200,000	10	*	....	....	.....	610,000	Sept	1882	.30
84	Leadville Cons., S. L.	Colo.	4,000,000	400,000	10	*	....	....	.....	423,000	Apl.	1887	.05
85	Lexington, G. S.	Mont	4,000,000	40,000	100	*	....	....	.....	565,000	Jan.	1885	2.00
86	Little Chief, S. L.	Colo.	10,000,000	200,000	50	*	....	....	.....	800,000	July	1888	.10
87	Little Pittsburg, S. L.	Colo.	20,000,000	200,000	100	*	....	....	.....	1,050,000	Mch.	1890	.50
88	Manhattan, S.	Nev	5,000,000	50,000	100	250,000	Dec.	1887	1.00	437,500	Feb	1886	.25
89	Marion Bullion, G.	N.C.	500,000	.....	....	*	....	....	.....	15.000	Jan.	1886	.....
90	Martin White, S.	Nev.,	10,000,000	100,000	100	1,175,000	Jan.	1889	25	140,000	Dec.	1888	.25
91	Mary Murphy, G.	Colo.	350,000	3,500	100	*	....	....	.....	175,000	May	1888	5.00
92	Minnesota, C.	Mich	1,000,000	40,000	25	420,000	Apl.	1886	1 00	1,826,000	Mar.	1876	.....
93	Mono, G.	Cal.	5,000,000	50,000	100	641,000	Sept	1888	.50	12.500	Mar.	1886	.25
94	Montana, Lt., G. S.	Mont	3,300,000	660,000	5	*	....	....	.....	2,190,285	Jan.	1889	.06¼
95	Morning Star, S. L.	Colo.	1,000,000	100,000	10	*	....	....	.....	775,000	Mar.	1888	.25
96	Moulton, S. G.	Mont	2,000,000	400,000	5	*	....	....	.....	380,000	Dec.	1887	.07½
97	Mount Pleasant, G.	Cal.	150,000	150,000	1	*	....	....	.....	150,000	Feb.	1887	.30
98	Mt. Diablo, S.	Nev.	5,000,000	50,000	100	137,500	Jun.	1880	2.00	140,000	Feb.	1889	.40
99	Napa, Q.	Cal.,	700,000	100,000	7	*	....	....	.....	290,000	Jan.	1883	.10
100	Navajo, G. S.	Nev.,	10,000,000	100,000	100	485,000	Apl.	1888	.30	335,000	Jan.	1889	.10
101	New Guston, S.	Colo.	500,000	100,000	5	*	....	....	.....	100,000	Dec.	1888	.50
102	N. Hoover Hill, G. S.	N. C.	300,000	120,000	2½	*	....	....	.....	30.000	Dec.	1885	.06⅓
103	Northern Belle, S.	Nev.,	5,000,000	50,000	100	425,000	Jan.	1884	8.50	2,400,000	Apl.	1883	.50
104	North Belle Isle, S.	Nev.,	10,000,000	100,000	100	350,000	Jan	1889	.50	230,000	May	1888	.50
105	North Star, G.	Cal.,	1,000,000	100,000	10	*	....	....	.....	150,000	Dec.	1888	.50
106	Ontario, S. L.	Utah	15,000,000	150,000	100	*	....	....	.....	9,800,000	Jan.	1889	.50
107	Ophir, G. S.	Nev.,	10,000,000	100,000	100	4,109,440	Sept	1888	.50	1,595,800	July	1882	1.00
108	Original, S. C.	Mont	1,500,000	60,000	25	*	....	....	.....	123.000	July	1888	.05
109	Osceola, C.	Mich	1,250,000	50,000	25	480,000	Apl.	1876	1.60	1,222,500	Mar.	1889	1 00
110	Oxford, G.	N. S.	125,000	125,000	1	*	....	....	.....	34,500	Oct.	1885	.02
111	Paradise Valley, G. S.	Nev.	10,000,000	100,000	100	57,000	Apl.	1888	.15	150,000	Apl.	1887	.10
112	Parrott, S.	Mont	1,800,000	180,000	10	*	....	....	.....	354,000	Jan.	1889	.10
113	Peacock, S. G. C.	N.M.	2,000,000	200,000	10	*	....	....	.....	60.000	Nov.	1886	.....
114	Plutus, G. S. C. L.	Colo.	2,000,000	200,000	10	*	....	....	.....	20.000	Feb.	1886	.10
115	Plymouth Con., G.	Cal.,	5,000,000	100,000	50	*	....	....	.....	2,280,000	Feb.	1888	.40
116	Quicksilver, pref., Q.	Cal.,	4,300,000	43,000	100	*	....	....	.....	1,402,075	Mar.	1889	1.50
117	" com., Q.	Cal.,	5,700,000	57,000	100	*	....	....	.....	151,000	July	1882	.40
118	Quincy, C.	Mich	1,000,000	40,000	25	200,000	Dec.	1862	.....	5,170,000	Feb.	1889	5.00
119	Richmond, S.	Nev.,	1,350,000	90,000	15	*	....	....	.....	4,312,587	Jun.	1887	1.25
120	Ridge, C.	Mich.	500,000	20,000	25	219,939	Mar	1886	.50	99.735	Feb.	1880	.50
121	Robinson Con., S. L.	Colo.	10,000,000	200,000	50	*	....	....	.....	585,000	Mar.	1886	.05
122	Robert E. Lee, S. L.	Colo	10,000,000	500,000	20	*	....	....	.....	100,000	Dec.	1882	.50
123	Rooks, G.	Vt.,	500,000	50,000	10	*	....	....	.....	61,000	Apr	1885	.40
124	Savage, S.	Nev.,	11,200,000	112,000	100	3,486,000	Jan.	1889	.50	4,460,000	July	1889	3.00
125	Security L. Mg., Mfg.	Colo.	1,000,000	150,000	10	*	....	....	.....	50,000	July	1884	.....
126	Shoshone, G.	Idah.	150,000	150,000	1	*	....	....	.....	7,500	Apl.	1883	.01
127	Sierra Buttes, G.	Cal.,	2,225 000	122,500	10	*	....	....	.....	1,568,145	Apl.	1888	.12½
128	Sierra Nevada, G. S.	Nev.,	10,000,000	100,000	100	6,150,000	Nov	1888	.25	102,000	Jan.	1871	1.00
129	Sierra Nevada, S. L.	Idaho	1,000,000	¶	1	*	....	....	.....	20,000	June	1888	.01
130	Silver Cord, G. S. L.	Colo.	5,000,000	500,000	10	*	....	....	.....	225,000	Nov.	1883	.25
131	Silver King, S.	Ariz.	10,000,000	100,000	100	50,000	Jun.	1888	.50	1,950,000	July	1887	.25
132	Silver Mg. of L.	N. M.	500,000	500,000	1	*	....	....	.....	25,000	June	1888	.05
133	Silverton, G. S. L.	Colo.	2,000,000	200,000	10	*	....	....	.....	80.000	Nov.	1886	.02
134	Small Hopes Cons., S.	Colo.	5,000,000	250,000	20	*	....	....	.....	3,112,500	Dec.	1887	.20
135	Smuggler, S. L.	Colo.	600,000	60,000	10	*	....	....	.....	66,700	Aug.	1883	.25
136	Spring Valley, G.	Cal.,	200,000	200,000	1	50,000	Oct.	1886	.25	50,000	Jan	1881	.25
137	Standard, G. S.	Cal.,	10 000,000	100,000	100	25,000	Oct.	1884	.25	3,595,000	Jun.	1888	.05
138	Stormont, S.	Utah	500,000	500,000	1	*	....	....	.....	155,000	Nov	1881	.05
139	St. Joseph, L.	Mo.,	1,500,000	150,000	10	*	....	....	.....	844.00.	Dec	1887	.20
140	Surinam, G.	D. G.	3,000,000	600,000	5	*	....	....	.....	105,000	Nov.	1887	.05
141	Swansea, G.	Colo.	600,000	60,000	10	*	....	....	.....	9.000	Apl.	1888	.02½
142	Syndicate, G.	Cal.,	10,000,000	100,000	100	38,729	July	1882	.15	48,308	Sept	1885	.10
143	Tamarack, C.	Mich.	1,000,000	40,000	25	520,000	Apl.	1885	3.00	640,000	Dec.	1888	5.00
144	Tip Top, S.	Ariz.	10,000,000	100,000	100	250,000	Sept	1883	.25	100,000	Nov	1881	.20
145	Tombstone, G. S. L.	Ariz.	12,500,000	500,000	25	*	....	....	.....	1,250,000	Apl.	1882	.10
146	United Verde, C.	Ariz.	3,000,000	300,000	10	*	....	....	.....	97,500	Feb.	1884	.20
147	Valencia, M.	N. M.	150,000	1,500	100	*	....	....	.....	97,500	Apl	1886	2.50‡
148	Viola L., S. L.	Idah.	750,000	150,000	5	*	....	....	.....	272,500	Oct.	1888	.37½
149	Yankee Girl	Colo.	2,500,000	250,000	10	.....	....	....	.....	1,275,000	July	1887	.10
150	Yellow Jacket, G. S.	Nev.,	12,000000	120,000	100	5,440,000	Dec	1885	.75	2,184,000	Aug.	1871	1.50

NON-DIVIDEND-PAYING MINES

	Name and Location of Company.	Capital Stock.	Shares. No.	Shares. Par Value.	Assessments. Total levied.	Assessments. Date & am't of last.			
1	Agassiz Cons., S. L.	Colo.	$2,500,000	50,000	$50	*	....	....	....
2	Alloues, C.	Mich	2,000,000	80,000	25	$657.000	Jun	1888	1.00
3	Alpha Con., G. S.	Nev.,	3,000,000	30,000	100	562.500	Nov.	1888	87½
4	Alta, S.	Nev.,	10,080,000	100,800	100	2,248,800	Sept	1888	.50
5	Amador, G.	Cal.,	400,000	200,000	2	*	....	....	....
6	American Flag, S.	Colo.	1,250,000	125,000	10	300,000	Jun	1877	.50
7	Anglo-Montana, Lt.	Mon.	600,000	120,000	5	.....	....	....	....
8	Annie Mohan, Lt., G.	N. C.	1,500,000	300,000	5	*	....	....	....
9	Astoria, G.	Cal.,	200,000	100,000	2	*	....	....	....
10	Barcelona, G.	Nev.,	5,000,000	200,000	25	*	....	....	....
11	Bechtel Con., G.	Cal.,	10,000,000	100,000	100	173,500	Jan.	1883	.10
12	Belmont, S.	Nev.,	5,000,000	50,000	100	735.000	Apl.	1886	.10
13	Best & Belcher, G. S.	Nev.,	10,080,000	100,800	100	2,104,990	Jan.	1889	.25
14	Big Pittsburg, S. L.	Colo.	20,000,000	200,000	100	*	....	....	....
15	Bi-Metallic, G.	Mon.	5,000,000	200,000	25	*	....	....	....
16	Black Oak, G.	Cal.,	3,000,000	300,000	10	*	....	....	....
17	Boston Con., G.	Cal.,	10,000,000	100,000	100	170,000	Nov	1883	.25
18	Bremen, S.	N. M	5,000,000	500,000	10	*	....	....	....
19	Brunswick, G.	Cal.,	2,000 000	400,000	5	*	....	....	....
20	Bullion, G. S.	Nev.,	10,000,000	100,000	100	4,007,000	Aug.	1888	.50
21	Bye and Bye	Ariz.	1,000,000	100,000	10	*	....	....	....
22	Calaveras, G.	Cal.,	500,000	100,000	1	*	....	....	....
23	Carisa, G.	Wy	500,000	100,000	5	*	....	....	....
24	Carupano, G. S. L. C.	Ven.	200,000	100,000	2	*	....	....	....
25	Cashier, G. S.	Colo.	500,000	250,000	2	*	....	....	....
26	Cen. Contin'l, G. S. L.	C. & A	2,000,000	200,000	10	*	....	....	....
27	Charles Dickens, G. S.	Idah.	1,250,000	250,000	5	*	....	....	....
28	Chollar, S.	Cal.,	1,500,000	150,000	10	.....	....	....	....
29	Cleveland, T.	Dak	11,200,000	112,000	100	1,428,000	Oct.	1888	.50
30	Colchis	N. M.	1,000,000	500,000	2	*	....	....	....
31	Comstock, G. S.	N.M.	500,000	50,000	1	*	....	....	....
32	Con. Imperial, G. S.	Nev.,	10,000,000	100,000	100	30 000	Mar.	1887	.15
33	Con. Pacific, G.	Nev.,	5,000,000	50,000	100	1,800,000	Nov.	1888	.05
34	Cons. Silver, S.	Cal.,	6,000,000	60,000	100	180,000	F b.	1889	.10
35	Courtlandt, S.	Mo.,	2,500,000	250,000	10	*	....	....	....
36	Courtlandt, S.	Colo.	500,000	50,000	10	*	....	....	....
37	Crescent, S. L.	Colo.	3,000,000	300,000	10	*	....	....	....
38	Crocker, S.	Ariz.	10,000,000	100,000	100	105,000	Feb.	1888	.25
39	Crowell, G.	N. C	500,000	500,000	1	*	....	....	....
40	Dahlonega, G.	Ga.,	250,000	250,000	1	*	....	....	....
41	Dandy, S.	Colo.	5,000,000	500,000	10	*	....	....	....
42	Dardanelles, G.	Cal.,	1,000,000	100,000	10	*	....	....	....
43	Decatur, S.	Colo.	1,500,000	300,000	5	*	....	....	....
44	Denver City, S. L.	Colo.	5,000,000	500,000	10	*	....	....	....
45	Denver Gold, G.	Colo.	300,000	60,000	5	*	....	....	....
46	Durango, G.	Colo.	500,000	500,000	1	*	....	....	....
47	Eastern Dev. Co., Lt.	N. S.	1,500,000	150 000	10	990,000	Mar.	1886	1.00
48	El Cristo, G. S.	U.S.C	1,000,000	500,000	2	*	....	....	....
49	El Dorado, G.	Cal.,	1,000,000	250,000	4	*	....	....	....
50	El Talento, G.	U.S.C	1,000,000	500,000	2	*	....	....	....
51	Empire, S.	Utah	10,000,000	100,000	100	*	....	....	....
52	Eureka Tunnel, S. L.	Nev.,	10,000,000	100,000	100	*	....	....	....
53	Exchequer	Nev	10,000,000	100,000	100	790,000	Sept	1888	1.20
54	Found Treasure, G. S.	Nev.,	10,000,000	100,000	100	18,000	July	1882	1.06
55	Gogebic L. Sya., I.	Wis.	5,000,000	200,000	25	.....	....	....	....
56	Gold Cup, S.	Colo.	500,000	500,000	1	*	....	....	....
57	Golden Era,	Mon.	2 000,000	200,000	10	*	....	....	....
58	Gold Placer, G.	Colo.	5,000,000	200,000	25	229,314	Dec.	1885	.25
59	Gold Rock, G.	Cal.	1,000,000	500,000	2	*	....	....	....
60	Goodshaw, G.	Cal.,	10,000,000	100,000	100	.....	....	....	....
61	Grand Belt, C.	Tex.	12,000,000	120,000	100	.....	....	....	....
62	Grand Duke	Colo.	800,000	80,000	10	*	....	....	....
63	Great Remance, G.	U.S.C	1,000,000	500,000	2	*	....	....	....
64	Gregory-Bobtail, G.	Colo.	550,000	550,000	1	*	....	....	....
65	Gregory Con., G.	Mon.	3,000,000	300,000	10	.....	....	....	....
66	Harlem M. & M. Co, G.	Cal.,	1 000,000	200,000	5	.....	....	....	....
67	Head Cent. & Tr. S. G.	Ariz.	10,000,000	100,000	100	.....	....	....	....
68	Hector, G.	Cal.,	1,500,000	300,000	5	.....	....	....	....
69	Highland, C.	Mich	500,000	25,000	20	.....	....	....	....
70	Hollywood	Cal.,	200,000	100,000	2	.....	....	....	....
71	Hortense, S.	Colo.	2,000,000	200,000	10	.....	....	....	....
72	Huron, C.	Mich	1,000,000	40,000	25	280,000	May	1887	3.00
73	Iron Gold & Silver, S.	N. M.	2,000,000	200,000	10	*	....	....	....
74	Ironton, I.	Wis.	1,000,000	40,000	25	.....	....	....	....
75	Iroquois, C.	Mich	1,250,000	50,000	25	*	....	....	....
76	J. D. Reymert, G.	Ariz.	10,000,000	100,000	100	.....	....	....	....
77	Julia Cons., G. S.	Nev.,	11,000,000	110,000	100	1,660,000	Jan.	1889	.10
78	Kearsarge, C.	Mich	1 250,000	50,000	25	190,000	Oct.	1887	1.00
79	Lacrosse, G.	Colo.	1 000,000	100,000	10	*	....	....	....
80	Lee Basin, S. L.	Colo.	5,000,000	500,000	10	*	....	....	....
81	Lucerne, S.	Colo.	5,000,000	500,000	10	*	....	....	....
82	Mammoth Bar, G.	Cal.,	10,000,000	100,000	100	50,000	Dec.	1883	.....
83	May Belle, G.	Cal.,	10,000,000	100,000	100	84,000	Mar.	1884	.15
84	Mayflower Gravel,	Cal.,	1,000,000	100,000	10	485,000	Jan	1889	.50
85	Medora, G.	Dak.	250,000	250,000	1	*	....	....	....
86	Mexican, G. S.	Nev.,	10,000,000	100,000	100	2,725,760	Aug.	1888	.25
87	Middle Bar G.	Cal.,	400,000	200,000	2	*	....	....	....
88	Mike & Starr, S. L.	Colo.

NEW YORK MINING STOCKS QUOTATIONS.

DIVIDEND-PAYING MINES

NAME AND LOCATION OF COMPANY.	Feb 9.		Feb. 11.		Feb. 12.		Feb. 13.		Feb. 14.		Feb. 15.		SALES.
	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	
Adams, Colo.	....	.....	....	....	.....	....	....	....	....	....	....	....	.....
Alice, Mont	.....	.....	....	....	.....	....	....	....	....	....	....	....	.....
Argenta, Nev.	.....	.....	....	....	....	....	....	....	....	....	....	....	.....
Bassick, Colo.	.....	.....	....	....	.....	....	....	....	....	....	....	....	.....
Belcher, Nev	....	.....	....	....	.....	....	....	....	....	....	....	....	.....
Belle Isle, Nev.	....	.....	....	....	....	....	.40	.35	....	....	....	....	1,600
Bodie Cons., Cal.	....	.....	....	....	....	....	....	....	1.65	....	....	....	400
Breece, Colo	....	.....	....	....	....	....	....	....	....	....	....	....	.....
Bulwer, Cal	....	.....	....	....	....	....	....	....	....	....	....	....	.....
Caledonia, Dak	....	.....	....	....	....	....	....	....	2 80	....	....	....	100
Calumet & Hecla	....	.....	....	....	....	....	....	....	....	....	....	....	.....
Choliar, Nev	....	.....	....	....	....	....	....	....	....	....	....	....	.....
Chrysolite, Colo.	....	.....	....	....	....	....	....	....	....	....	....	....	.....
Colorado Cent'l, Colo.	....	.....	....	....	....	....	....	....	....	....	....	....	.....
Cons. Cal. & Va., Nev.	8.63	.....	....	....	8.25	7.88	8.50	7.75	7.75	....	7.88	7.75	2,100
Crown Point, Nev	....	.....	....	....	....	....	....	....	....	....	....	....	.....
Deadwood, Dak	....	.....	....	....	....	....	1.75	....	....	....	....	....	20
Dunkin, Colo.	1.05	.....	....	....	....	....	....	....	....	....	....	....	50
Eureka Cons., Nev	....	.....	....	....	....	....	....	....	....	....	....	....	.....
Father de Smet, Dak	....	.....	....	....	....	....	....	....	....	....	....	....	400
Gould & Curry, Nev.	....	.....	....	....	....	....	....	....	....	....	....	....	.....
Grand Prize, Nev.	....	.....	....	....	....	....	....	....	....	....	....	....	.....
Hale & Norcross, Nev	4 50	4.40	....	....	4 25	4.00	....	....	....	....	....	....	800
Holyoke, Idaho	....	....	....	....	....	....	....	....	.05	....	.06	....	800
Homestake, Dak.	....	....	....	....	14 00	13.00	....	....	13.00	....	13.50	....	1,150
Horn-Silver, Ut.	....	....	....	....	.80	....	....	....	....	....	....	....	100
Iron Hill, Dak.	....	....	....	....	....	....	....	....	.20	....	....	....	500
Iron Silver, Colo.	....	....	....	....	3.50	....	....	....	....	....	....	....	400
Leadville C., Colo.	.11	....	12	.11	....	....	.11	....	.13	.11	.13	....	3,700
Little Chief, Colo.	.27	.26	.25	....	.26	.25	.27	....	.28	....	....	....	3,900
Little Pittsburg, Colo	....	....	....	....	....	....	....	....	....	....	.08	....	100
Martin White, Nev.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Mono, Cal	....	....	....	....	....	....	....	....	....	....	....	....	.....
Moulton, Mont.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Mount Diablo, Nev.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Navajo, Nev	.....	.....	....	....	1.50	1.46	....	....	....	....	....	....	300
North Belle Isle, Nev.	....	....	....	....	2.55	....	....	....	....	....	....	....	200
North Star, Cal.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Ontario, Ut.	....	....	35.00	....	35 00	34.50	35 00	....	....	....	35 00	34.25	754
Ophir, Nev	....	....	....	....	....	....	....	....	....	....	....	....	.....
Plutus, Colo.	1.05	1.00	1.00	....	1.00	....	....	....	1.00	....	1.05	....	1,500
Plymouth, Cal.	....	....	....	....	....	....	8.75	....	9.00	8.88	....	....	600
Quicksilver Pref., Cal	.....	.....	38 00	....	....	....	38.25	....	....	....	38.50	37.50	630
" Com., Cal	....	....	7.25	....	7.50	....	7.50	....	7.38	....	....	....	550
Robinson Cons. Colo.	.50	.....	.....	....	....	....	....	....	....	....	....	....	800
Savage, Nev.	.....	.....	....	....	2.90	....	....	....	....	....	....	....	100
Sierra Nevada, Nev.	3 05	....	....	....	....	....	....	....	....	....	....	....	100
Silver King, Ariz.	....	....	1 10	....	....	....	....	....	1.10	....	1.10	....	600
Silver Mg. of L. V.	.52	.43	.45	.40	.....	....	....	....	....	....	....	....	2,600
Small Hopes, Colo.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Standard, Cal.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Stormont, Utah	.07	.....	....	....	.06	.....	....	....	....	....	....	....	2,100
Yellow Jacket	....	....	....	....	....	....	4.00	....	....	....	3.70	....	600

NON-DIVIDEND-PAYING MINES.

NAME AND LOCATION OF COMPANY.	Feb. 9.		Feb. 11		Feb. 12.		Feb. 13.		Feb. 14.		Feb. 15.		SALES.
	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	
Allouez, Mich.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Amador, Cal.	1 90	....	1.90	....	1.95	...	1.99	1.85	1.80	....	1.80	....	2,500
American Flag, Colo	....	....	....	....	....	....	....	....	....	....	....	....	.....
Astoria, Cal.	.20	...	.20	....	.20	....	20	....	.20	....	.20	....	8,100
Barcelona, Nev.	....	....	.80	.79	.88	.84	.76	.75	....	....	....	....	1,200
Bechtel, Cal.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Best & Belcher, Nev.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Brunswick, Cal.	.09	....	.11	.09	.13	.11	17	.12	.17	.16	.16	.15	29,800
Buffalo Iron Min'g.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Bullion, Nev.	1.45	....	1.45	....	....	....	....	....	....	....	1.55	....	500
Cashier, Colo	.05	....	....	....	.05	....	06	.05	.05	....	.05	....	4,800
Castle Creek, Id.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Central Arizona	....	....	....	....	....	....	....	....	....	....	....	....	.....
Colchis, N. M.	2.00	1.95	2.00	....	2 05	2.00	2.00	....	2.10	2.00	2.15	2.10	1,900
Commonw'lth, Nev	....	....	....	....	5.00	....	....	....	....	....	....	....	500
Con. Imperial, Nev	....	....	....	....	.75	....	....	....	....	....	.60	....	1,700
Con Pacific	....	....	....	....	....	....	....	....	....	....	....	....	.....
Del Monte	....	....	....	....	....	....	....	....	....	....	....	....	.....
Denver City, Colo.	....	....	....	....	....	....	....	....	....	....	....	....	400
Eastern Oregon	....	....	....	....	....	....	....	....	....	....	....	....	.....
El Cristo, U. S. Col.	1.30	1.25	1.35	1 30	1.35	....	1 40	1.30	1.45	1.35	1.45	1.40	8,900
Excelsior, Cal	....	....	....	....	....	....	....	....	....	....	....	....	.....
Exchequer, Nev.	1.40	....	....	....	....	....	1 45	....	....	....	....	....	200
Hollywood, Cal.	.02	....	....	....	....	....	....	....	....	....	.03	....	2,000
Huron, Mich.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Julia, Nev	....	....	....	....	....	....	....	....	....	....	....	....	.....
Kingst'n & Pemb'ke	1.50	1.25	1.50	....	1.50	1.38	....	....	....	....	1.50	1 38	1,840
Kossuth, Nev.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Lacrosse, Colo	.09	....	....	....	....	....	....	....	....	....	....	....	2,500
Lee Basin, Colo	....	....	....	....	....	....	....	....	....	....	....	....	.....
Mexican Nev.	....	....	....	....	3.15	....	....	....	....	....	3.10	....	200
Middle Bar, Cal.	31	....	.30	....	.30	....	.30	....	.30	....	.30	....	2,900
Monitor, Colo.	....	....	.05	....	....	....	....	....	....	....	.05	....	1,700
Mutual Sm. & M. Co	1 50	1.45	1 45	....	....	....	1.45	....	1.45	....	1 4	....	3,500
N Commonwealth	....	....	....	....	....	....	....	....	....	....	....	....	.....
Oriental & Mill., Nev	.08	....	.10	.09	.09	....	....	....	....	....	....	....	4,000
Phœnix of Ark.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Proustite, Idaho	1.05	....	1.00	.90	....	....	....	....	....	....	....	....	1,000
Rappahannock, Va	.09	....	.09	....	.09	....	.09	.08	.09	....	.09	....	5,800
Santiago U. S. C.	3 35	....	....	....	....	....	....	....	....	....	....	....	1,200
Shoshone, Idaho	.08	....	....	....	....	....	.08	....	.08	....	.08	....	4,400
Silver Cliff, Colo.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Silver Cord, Colo.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Silver Hill, Nev	....	....	....	....	....	....	....	....	....	....	....	....	.....
Silver Queen	....	....	....	....	....	....	....	....	....	....	....	....	.....
State Line, 2&3, Nev.	.03	....	....	....	....	....	....	....	....	....	....	....	1,000
Sullivan Con	1.25	....	1.30	1 25	1.40	1.30	1.40	1 30	1.40	1 25	1.40	1.30	23,600
Sutro Tunnel, Nev.	....	....	....	....	....	....	.09	....	.09	.08	11	.10	12,600
" Trust Cert.	....	....	.60	....	.58	....	.60	.59	.59	....	.59	....	54,500
Sylvanite M. & M. Co	....	....	....	....	....	....	....	....	....	....	....	....	.....
Tornado, Nev.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Union Cons., Nev.	....	....	....	....	....	....	....	....	....	....	....	....	.....
United Copper	1.10	....	1.15	....	1.15	....	1 05	....	1 00	....	1 15	....	200

Ex. dividend. †Dealt in at the New York Stock Ex. Unlisted Securities ‡Assessment paid. Dividend shares sold, 26,054. Non-dividend shares sold, 179,140. Total New York 205,194

BOSTON MINING STOCK QUOTATIONS.

NAME OF COMPANY.	Feb. 8.		Feb. 9.		Feb. 11.		Feb. 12.		Feb. 13		Feb. 14.		SALES.
Atlantic, Mich.	14 00	.....	.....	.....	15.00	....	15.00	14.5	14.50	14.00	14.50	.....	232
Bodie, Cal.	.....	.....	.....	.....	.....	....	.....	.....	.....	.....	.....	.....	.....
Bonanza Developm't	1.38	.....	1.38	.....	1.38	....	.....	.....	.....	.....	1.38	1.25	775
Bost. & Mont., Copper	53 00	52.00	52.00	51.00	51.00	49.50	49.50	46.50	47.50	45.50	47.00	46.00	4,321
Breece, Colo.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Calumet & Hecla	279	.....	277	272	270	.....	271	270	271	269	262	260	178
Catalpa, Colo.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Central, Mich.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Chrysolite, Colo	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Con. Cal. & Va., Nev.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dunkin, Colo.	.....	.....	97.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	100
Enterprise	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Franklin, Mich.	14.88	14.75	15.00	15 00	.....	.....	16 00	14.50	14.00	13 75	14.00	13.75	817
Hale & Norcross, Nev.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Honorine, Utah	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Little Chief, Colo.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Little Pittsburg, Colo.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Martin White, Nev.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mono, Cal.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Napa, Cal.	.....	.....	3.75	.....	.....	.....	.....	.....	3.25	.....	3.50	.....	550
Ontario	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Osceola, Mich	18.00	17.75	17 50	.....	.....	.....	17.00	.....	17.00	16.00	16.00	.....	265
Pewabic, Mich.	.....	.....	.....	.....	.....	.....	5.00	.....	.....	.....	4.63	.....	300
Quincy, Mich.	70.50	71.00	.....	.....	70.50	.....	70 50	.....	70 50	70.00	.....	.....	103
Ridge, Mich.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sierra Nev., Nev.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Silver King, Ariz.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Standard, Cal	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tamarack, Mich.	152	150	.....	.....	147	.....	146	143½	143	142	.....	.....	224

NAME OF COMPANY.	Feb. 8.		Feb. 9.		Feb. 11.		Feb 12		Feb. 13.		Feb. 14.		SALES.
Allouez, Mich.	.....	.....	4.10	3.88	4.00	.....	3.88	3.75	3.75	.....	3.75	.....	1,900
Arnold, Mich.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Aztec, Mich.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Brunswick, Cal.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Butte & Boston	.....	.....	.....	.....	25.00	.....	.....	.....	.....	.....	.....	.....	.....
Canada	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50
Cashier, Colo.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Crescent, Colo.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cusi, N. Mex.	....	....	....	....	....	....	....	....	....	....	....	....	.....
Denver City, Colo.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
El Cristo, W. S. C.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Everett	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hanover, Mich.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Humboldt, Mich.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hungarian	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Huron, Mich.	.....	.....	4 50	.....	4 50	4.25	4.13	4.00	.....	.....	4.00	.....	305
Kearsarge, Mich.	.....	.....	.....	.....	9 50	.....	.....	.....	9.00	8 50	8.75	8.00	425
Mesnard, Mich.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
National, Mich.	5.25	.....	.....	.....	.....	.....	4 75	4.50	4.50	.....	4.50	.....	770
Native, Mich.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pontiac	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Rappahannock, Va	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Rockland	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Santa Fe, N. Mex.	2.38	2.13	2.37	2 37	2 25	2.18	2 25	2 00	2.13	2.00	2 06	2.00	7,100
Security, Colo	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Shoshone Idaho	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
South Side, Mich.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St Louis Cop.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sullivan, Dak	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Boston: Dividend shares sold, 7,865. Non-dividend shares sold, 10,550. Total Boston, 18,415.

COAL STOCKS.

NAME OF COMPANY.	Par val. of sh'rs.	Feb. 9.		Feb. 11.		Feb. 12.		Feb. 13.		Feb. 14		Feb. 15		Sales.
		H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	
American Coal.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Barclay Coal.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cameron Coal & Iron Co	.....	31⅝	30¾	32¼	31¾	32¾	32	32¼	32¼	32¾	32¼	33	32	5,945
Ches. & O. RR.	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Chic. & Ind. Coal RR.	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do. pref.	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Col. & Hocking Coal	100	.....	.....	21	.....	.....	.....	.....	.....	21	.....	.....	.....	200
Col., C. & I	100	36¼	36	36¼	36	36½	35¾	.....	.....	36	35	36⅜	35½	4,635
Consol. Coal	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Del. & H. C.	100	137	136¾	136⅞	.....	137¼	136¼	137⅜	.....	137⅝	136¾	137¾	137⅛	4,773
D., L. & W. RR.	50	141¾	141¼	141¾	141¼	142	141⅛	142⅛	141⅜	142¾	142	142⅝	142	91,130
Hocking Valley	100	27	26½	27½	26¾	26¾	.....	27	26⅜	.....	.....	27⅜	27	10,060
Hunt. & Broad Top	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do. pref.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lehigh C. & N.	50	51⅞	51⅝	.....	.....	46½	46¼	46¼	.....	46	.....	.....	.....	668
Lehigh & W. B. Coal	.....	.....	.....	.....	.....	52	51⅞	52⅛	52	.....	.....	.....	.....	1,021
Lehigh Valley RR.	50	54¾	.....	54¾	.....	54⅝	54⅛	54⅛	.....	54¾	.....	.....	.....	798
Marshall Con. Coal	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	9	140
Mahoning Coal	.....	42½	.....	42½	.....	.....	.....	.....	.....	.....	.....	.....	.....	200
Maryland Coal	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Morris & Essex	100	150¼	150	.....	.....	.....	.....	.....	.....	148	.....	.....	.....	114
New Central Coal	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
N. J. C. RR.	100	.....	.....	97⅞	97⅝	97⅝	97½	98	.....	98¼	98	98	.....	2,525
N. Y. & S. Coal	100	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
N. Y., Susq. & Western	100	9	.....	9½	9¼	9⅛	9¼	9⅝	9⅜	9¼	.....	.....	.....	1,617
Do. pref.	100	.....	.....	.....	.....	34⅝	34	34¾	31½	34⅝	.....	.....	.....	1,400
N. Y. & Perry C. & I.	100	31⅝	31⅜	32	31⅜	31¾	31⅝	31½	31⅜	31¼	30¼	31⅛	30⅞	3,005
Norfolk & Western R.R.	100	.....	.....	17¼	17	17½	.....	.....	.....	17⅝	17¾	.....	.....	700
Do. pref.	50	51¾	51½	51½	.....	52¼	51¾	52¼	51⅝	52⅛	51⅞	.....	.....	2,537
Penn. Coal	50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Penn. RR.	50	55½	55⅜	55⅛	55⅜	55⅛	55¼	55¼	55⅛	55⅜	55⅛	.....	.....	9,713
Ph. & R. RR.**	50	48⅝	48½	48⅞	48⅛	48¾	48¼	48⅝	48½	49	48½	49⅛	48⅝	103,386
Sunday Creek Coal	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do. pref.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tennessee C. & I. Co.	100	34¾	.....	34¾	34⅛	31½	34	34¾	34⅛	34⅛	31⅛	35½	34	6,518
Do. Pref.	.....	99⅛	99	100½	99½	.....	.....	99¾	.....	100⅛	100	100¾	100	680
Westmoreland Coal.	100	70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9
Wyoming Valley Coal	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

**Of the sales of this stock, 25,416 were in Philadelphia, and 77,970 in New York. Total sales, 251,774.

San Francisco Mining Stock Quotations.

COMPANY	CLOSING QUOTATIONS. Feb. 8.	Feb. 9.	Feb. 11.	Feb. 12.	Feb. 13.	Feb. 14.
Alpha	.....	.....	.....	.....	.....	.....
Alta	2.35	.....	2.25	2.15	2.05	2.05
Belcher	.....	.....	.....	.....	.....	.....
Belle Isle	.....	.....	.....	.30	.35	.35
Best & Bel.	5.25	.....	5.00	4.75	4.25	4.35
Bodie	.....	1.60	1.55	1.60	.....	1.55
Bulwer	.....	.....	.....	.50	.....	.45
Challar	3.00	2.95	2.60	2.60	2.70	2.45
C'm'weal'h	5.13	.....	5.13	4.90	4.90	5.13
Con. C. & V	6.38	8.25	7.63	7.75	7.38	7.13
Con. Pac.	.....	.....	.....	.....	.....	.....
Crown Pt.	5.00	5.13	4.13	4.45	3.95	4.10
Eureka C.	2.00	.....	2.00	.....	.....	.....
Gould & C.	2.70	2.65	2.70	2.70	2.55	2.60
Grd. Prize.	.....	.....	.....	.....	.....	.....
Hale & N.	4.25	4.50	4.00	3.95	3.75	3.80
Mexican	3.40	3.35	3.10	3.20	2.90	3.00
Mono	1.10	.....	1.00	1.00	1.05	1.00
Mt. Diablo	.....	.....	.....	.....	.....	.....
Navajo	1.50	.....	1.50	1.50	1.45	1.45
Nev. Queen	3.10	.....	2.80	2.75	2.90	2.90
N. Belle I.	2.80	.....	2.50	2.60	2.70	2.75
Ophir	5.50	.....	5.25	5.13	4.90	5.00
Potosi	2.30	.....	2.05	2.10	2.00	2.10
Savage	3.25	3.10	2.95	2.85	2.70	2.85
Scorpion	.....	.....	.....	.....	.....	.....
Sierra Nev	3.15	3.10	2.95	3.00	2.80	2.80
Tip Top	.....	.....	.....	.....	.....	.....
Union Con.	3.10	3.05	2.90	2.90	2.80	2.80
Utah	1.35	1.30	1.20	1.25	1.15	1.20
Yellow Jkt.	4.30	4.30	4.00	3.90	3.60	3.50

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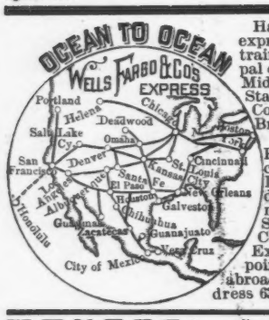

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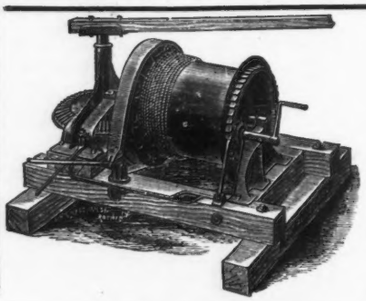

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